

STRUCTURE OF THE MICROCARD (BASIC INSTRUCTIONS)

A02 = How to use the microcard		1	2	3		4
A01 = Structure of microcard				SIS		
B01 = Trouble-shooting chart	-A-	***X*	X*XXX	XXXXX	XXXXX	*XXXX X
	-B-	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-C-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-D-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XXX
	-E-	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX XX
	-F-	XXXXX	XXXXX	XXXXX	XXX	
	-G-	XXXXX	XXXXX	XXXX		
	-H-					
	-J-					
	-K-					
	-L-					
	-M-					
N01 = Service Information	-N-	*XXXX	XXXXX	XXXXX	XXX	XX XX*
		12345	67890	12345	67890	12345 678
			1		2	

Index  
N28 = Table of contents and publication information  
1 = Special features  
2 = Safety and precautionary measures  
3 = Test equipment and tools  
4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

Beginning	Mid-section	End	One-page section

A01			
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HOW TO USE THE MICROCARD

Trouble-shooting instructions for  
System: L3.1-Jetronic  
Descriptions, photos, terminal designations and special features refer to the vehicle:

OPEL Omega-A  
with 1.8 l / 4-cylinder engine 10.86 ->

These basic instructions are detailed trouble-shooting instructions. They must not be used as vehicle-specific instructions.  
Caution: Descriptions and photos may differ from the vehicle-specific brief instructions.  
Binding set values, terminal designations and special features should be taken from the vehicle-specific brief instructions only.  
For brief instructions see table of contents Microcard KFZ-00..

A02			
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## SPECIAL FEATURES

- \* 15-pin control unit
- \* Control unit mounted directly on air-flow sensor.
- \* Air-flow sensor connected to control unit by an internal 4-pin plug-in connection.
- \* Air-flow sensor without bypass channel and CO adjusting screw.
- \* CO adjusting screw is on control unit
- \* Pump relay instead of control relay. The pump relay is energized by the control unit.
- \* Plausibility, i.e. in the case of defective sensors and/or leads, e.g. engine temperature, a substitute value is provided by the control unit, e.g. +80°C.  
This applies to the following sensors:  
Temperature sensor (engine),  
Temperature sensor (intake air),  
Throttle-valve switch (idle),  
Throttle-valve switch (full load).
- \* The air-flow sensor signal is brought out at a control-unit plug for further applications.
- \* Cold-start control, i.e. extra fuel injected through all injection valves.
- \* For supplementary information on the system, see Service Information "New System L3-Jetronic" VDT-I-KFZ/ 8 En.

## SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

### CAUTION!

High-performance ignition system with dangerous high and low voltages!

Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

For testing of compressions pressure, disconnect pump relay in order to prevent undesired injecting of the injection valves.

Do not short-circuit ignition coil term. 1 to ground (e.g. for switching off the engine). Ignition coil and possibly control unit will be destroyed.

Never connect positive pole of battery to ignition coil term. 1. Control unit will be destroyed.

If installing an alarm system, follow installation instructions for L-Jetronic vehicles or SIS microcard PKW 012. Make sure that the alarm relay is not disturbed by external fields (e.g. from ignition leads), thus incorrectly triggering.

SAFETY AND PRECAUTIONARY MEASURES  
(continued)

Never start engine without battery being firmly connected (battery terminals bolted tight). Do not disconnect battery from the vehicle electrical system with the engine running.

Do not use a fast charger for starting the engine.  
Render starting assistance only with a second 12 V battery and jumper cables.  
Caution! Due to non-uniform requirements placed by vehicle manufacturers on electronic products, we do not recommend the use of 24 V batteries for starting assistance.

When charging the battery in the vehicle or rendering starting assistance, observe the directions given in the operating instructions of the fast charger as well as those provided by the vehicle manufacturer.

Prior to charging or fast-charging the battery, disconnect it from the vehicle electrical system.

Incorrect polarity of the supply voltage, e.g. due to incorrect connection of the battery or ignition coil, can lead to irreparable damage to a control unit.

Do not connect or disconnect the wiring harness from control units or trigger-box with the ignition switched on.

Prior to exposure to temperatures above +80°C (paint-dry installation) remove control units.

Control units must be removed before electric spot welding.

TEST EQUIPMENT AND TOOLS

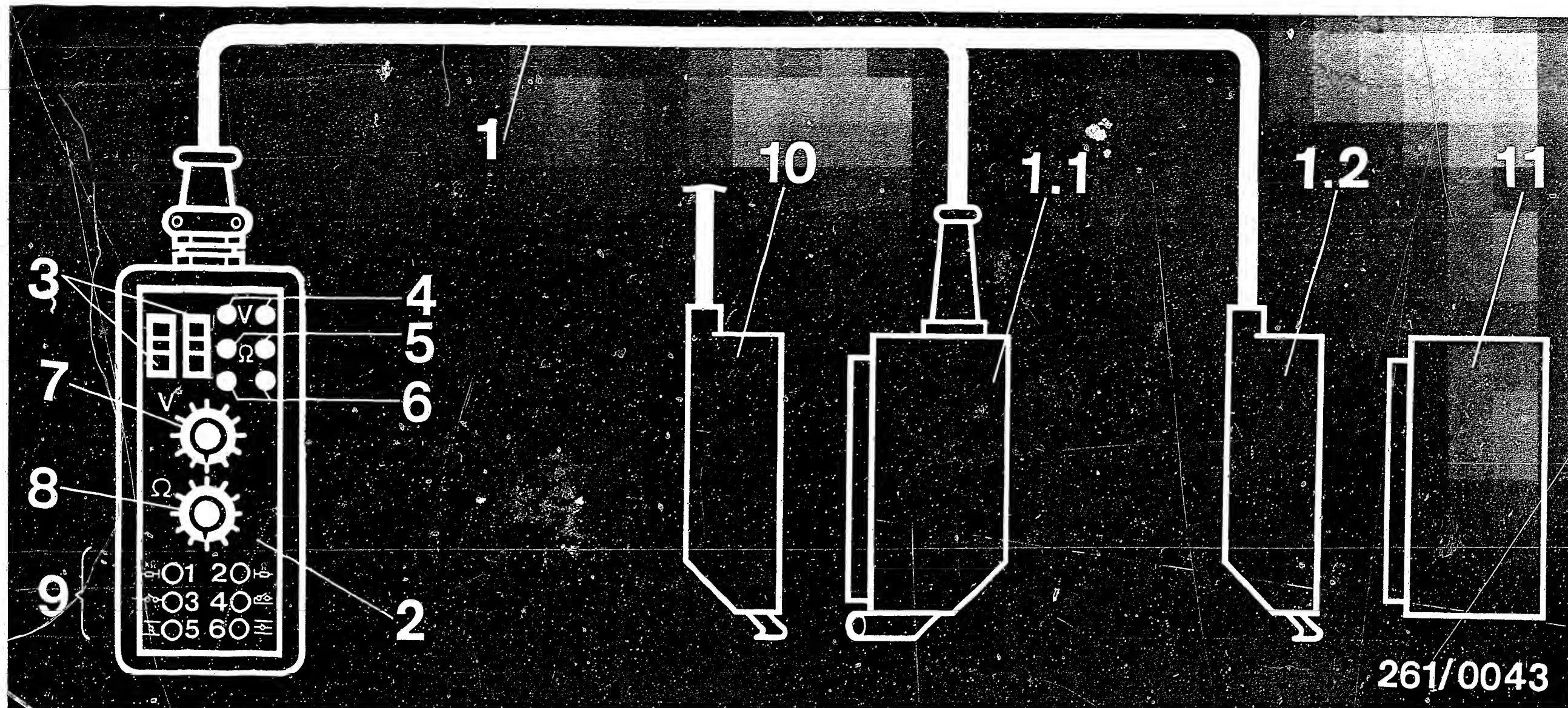
Description	Designation	Part no.
Universal test adapter	ETT 018.01	0 684 101 801
Adapter lead		1 684 463 168
Motor tester	e.g. MOT 002.00 MOT 300 MOT 400	0 684 000 200 0 684 000 300 0 684 000 400
Test lead		1 684 463 093
Exhaust-gas analyzer	e.g. ETT 008.00	0 684 100 800
Calibrated analyzers	ETT 008.04 ETT 008.05	0 684 100 804 0 684 100 805
Pressure tester e.g. Pressure gauge	Quality class 1.0 Measuring range 6 bar 0.1 bar divisions	1 687 231 154 KDJE-P 100
Pressure tester Pressure tester (no longer available) Three-way line Connecting part		KDEP 1034 KDJE-P 100/13 KDJE-P 100/14
Electrics tester or multimeter e.g.	ETE 014.00  Philips Miselco Fluke	0 684 101 400  PM 2517 X Master 50 K Multimeter 75 or 23

Use suitable commercially available tools for fitting and removing the idle CO anti-tamper device on the control unit.

Test equipment and tools (continued)

Description	Designation	Part no.
Parts set for injection valve and pressure regulator		1 287 010 704
Silicone grease for injection valves	Ft 2 v 1	5 700 080 125
Hand vacuum pump (Mityvac pump)	Korinth Ludwig-Kloos-Str. 21 6450 H a n a u 7 (Steinheim)	
Spark gap	EFAW 1177 / 7	1 684 531 000
Sleeve-type suppressor		0 365 500 003
Temperature sensor		0 280 130 028

For production reasons:  
continued on the following  
coordinate.

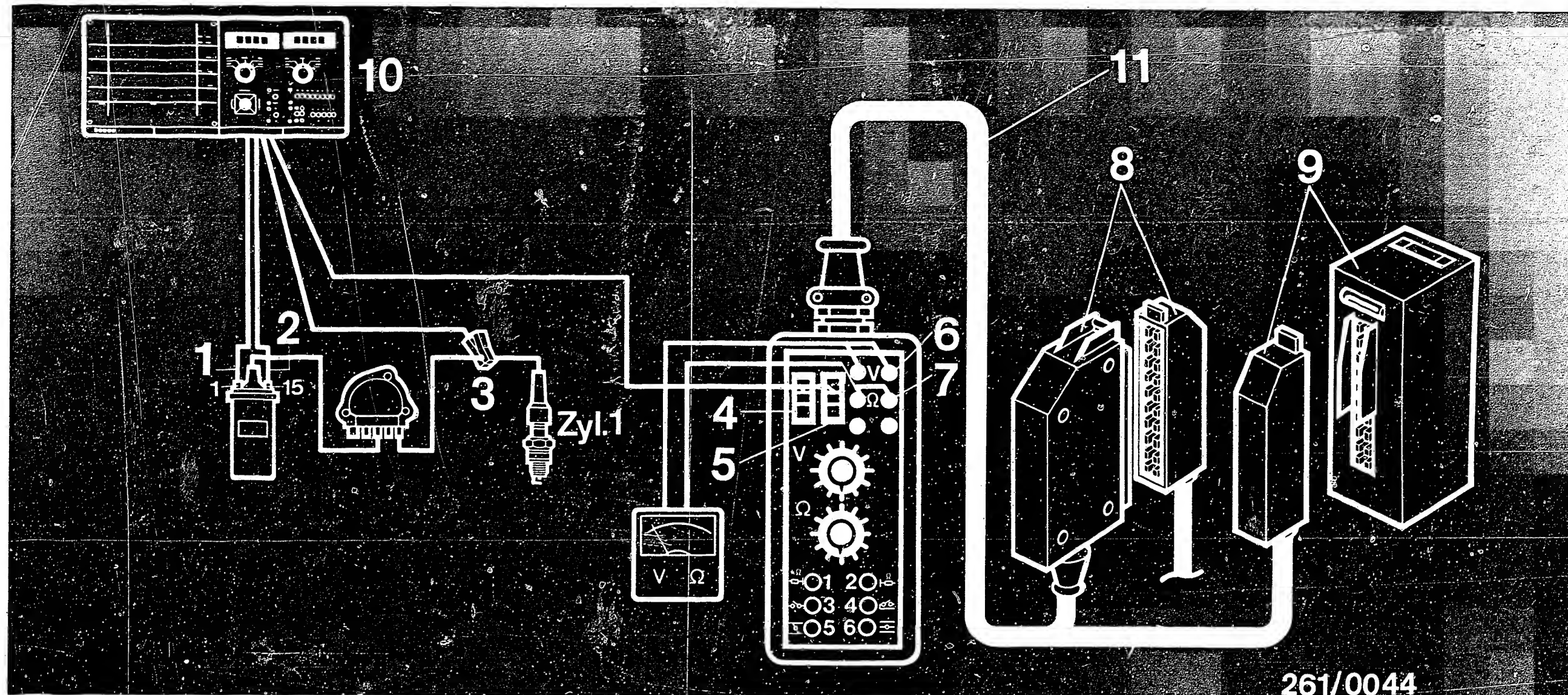


261/0043

Universal test adapter with adapter lead

- |     |  |          |   |
|-----|--|----------|---|
| 1   | = Adapter lead (1 684 463 168)           | 9        | = Button panel for simulation of operating conditions |
| 1.1 | = Connection to wiring harness           | Button 1 | = NTC II (engine), cold (-20°C)                       |
| 1.2 | = Connection to control unit             | Button 2 | = NTC II (engine), warm (+80°C)                       |
| 2   | = Universal test adapter (0 684 001 801) | Button 3 | = Pump energization                                   |
| 3   | = Test wells (for motortester)           | Button 4 | = Not used  |
| 4   | = Test sockets (voltage measurement)     | Button 5 | = Throttle-valve idle contact                         |
| 5   | = Test sockets (resistance measurement)  | Button 6 | = Throttle-valve full-load con.                       |
| 6   | = Not used                               | 10       | = Wiring harness                                      |
| 7   | = Program switch "V"                     | 11       | = Control unit  |
| 8   | = Program switch "Ω"                     |          |   |



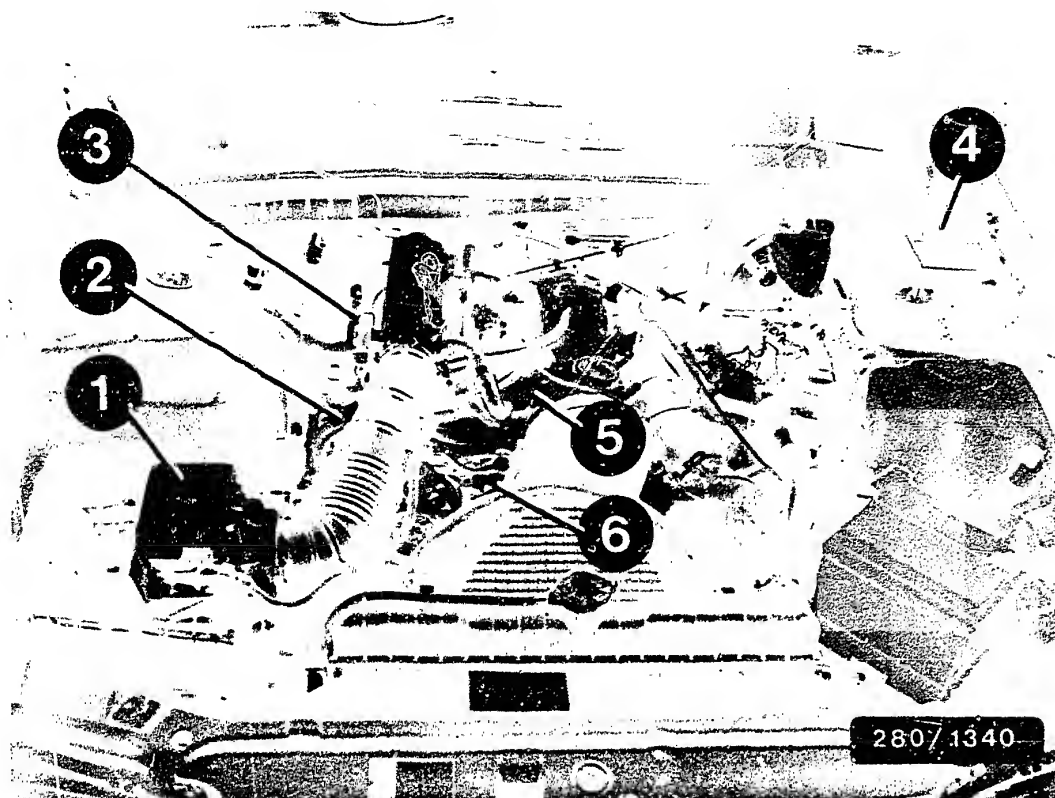


261/0044

- 1 = Green clip to ignition coil term. 1
- 2 = Yellow clip to ignition coil term. 15
- 3 = Induction-type clamp-on pickup over ignition cable of cylinder 1
- 4 = Red connection socket test well for red clamp of motortester
- 5 = Black connection socket (test well) for black clamp of motortester

- 6 = Connection of voltmeter at V sockets (red = +, black = ground/ -)
- 7 = Connection of ohmmeter at Ω sockets (blue)
- 8 = Connection to wiring harness
- 9 = Connection to control unit
- 10 = Motortester
- 11 = Adapter lead (1 684 463 133)

TERMINAL DIAGRAM FOR UNIVERSAL TEST ADAPTER

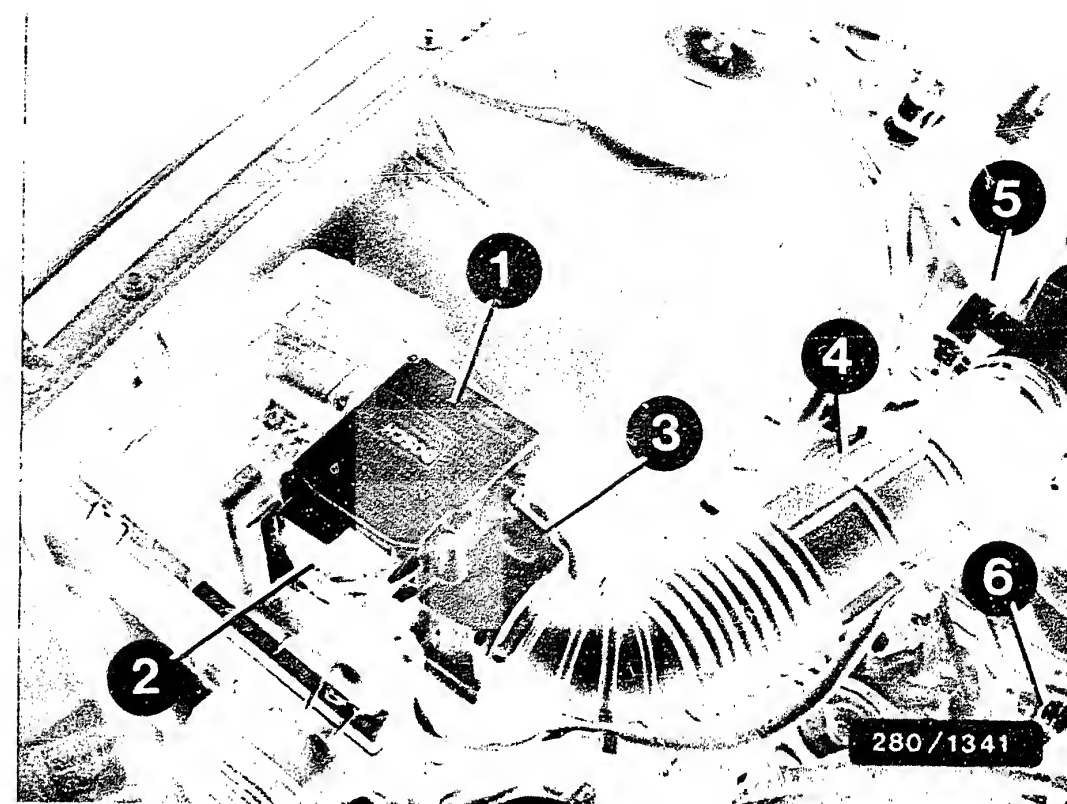


#### INSTALLATION POSITION OF COMPONENTS

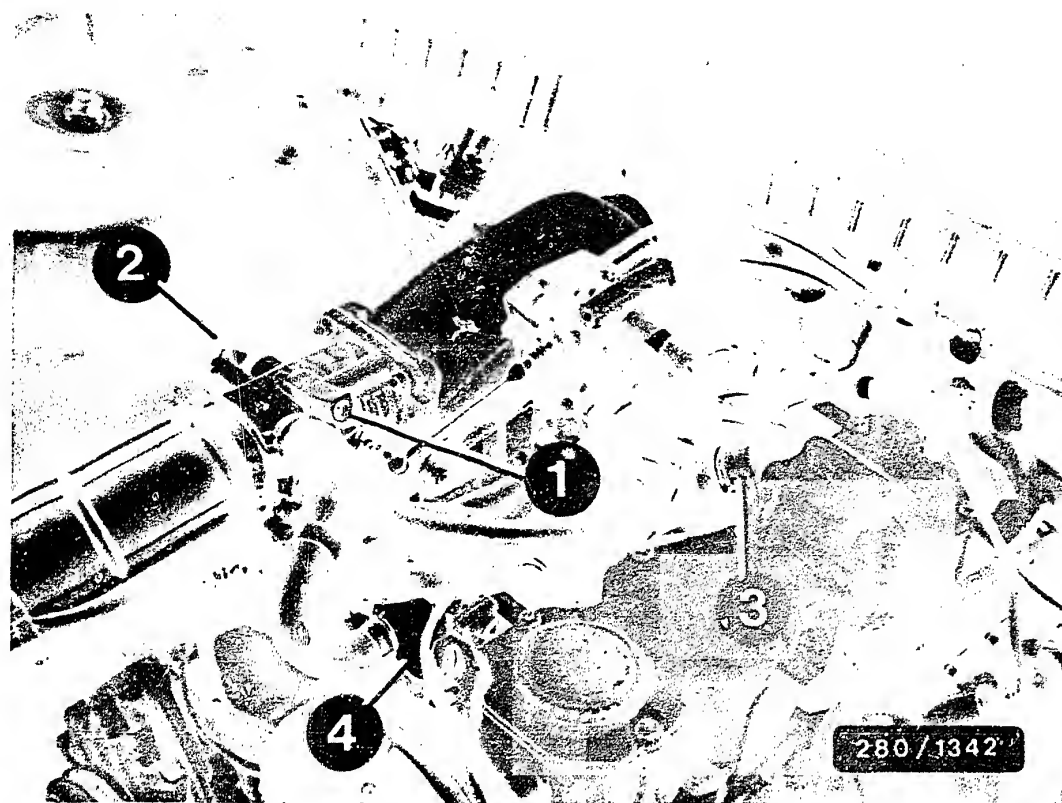
The indications "right" and "left" refer always to the forward direction of travel.

Arrangement of components in engine compartment.

- 1 = Measuring and control unit
- 2 = to pressure damper
- 3 = Throttle-valve switch
- 4 = Double relay (under cover)
- 5 = Auxiliary-air device
- 6 = Temperature sensor (engine)



- 1 = Measuring and control unit consisting of air-flow sensor and control unit
- 2 = 15-pin control-unit plug
- 3 = CO adjusting screw with anti-tamper cap
- 4 = to pressure damper
- 5 = Throttle-valve switch
- 6 = Temperature sensor (engine)



- 1 = Idle-adjusting screw
- 2 = Throttle-valve switch
- 3 = Pressure regulator
- 4 = Auxiliary-air device

For production reasons:  
continued on the following  
coordinate.



## Separate measuring and control unit

Removal and mounting of the control unit from the air-flow sensor is necessary only for the following operations:

- \* Electrical test of air-flow sensor (potentiometer and temperature sensor (intake-air)).
- \* Replacement of air-flow sensor
- \* Replacement of control unit

### Removal of control unit:

Unlatch 15-pin plug and remove.

Remove measuring and control unit from air-filter housing and loosen air-guide hose.

When removed, clean measuring and control unit, particularly area of plug, joint and screw-on points.

Use a clean cloth and benzine, if necessary.

Dry only with hot air! Compressed air is not allowable.

Avoid excessive jolting when handling.

Lever out anti-tamper cap of connecting screw.

Unscrew 4 connecting screws.

Remove control unit vertically upward, without tools.

Caution: do not tilt, do not damage sealing edges.

Do not soil interior of control unit or air-flow sensor, and be sure to avoid pressure on protective cover.

### Mounting of control unit:

Replace defective component, air-flow sensor or control unit.

Clean sealing groove on control unit and press in new steel ring, correctly positioned. Do not turn seal ring.

Clean seating surface on air-flow sensor.

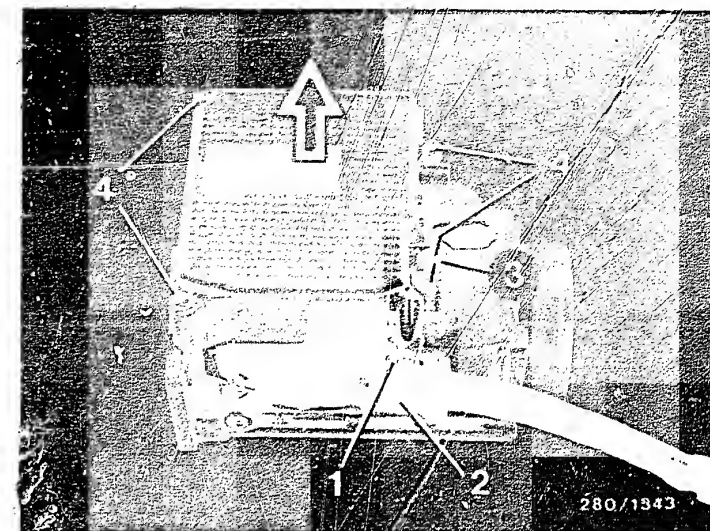
Place control unit on air-flow sensor and press in parallel.

Wet threads of 4 connecting screws with locking paint and screw in. Tighten cross-wise to 1.0...1.4 Nm torque. Press anti-tamper cap No. 1 280 508 004 onto connecting screw.

Screw measuring and control unit onto air-filter housing and mount air-guide hose.

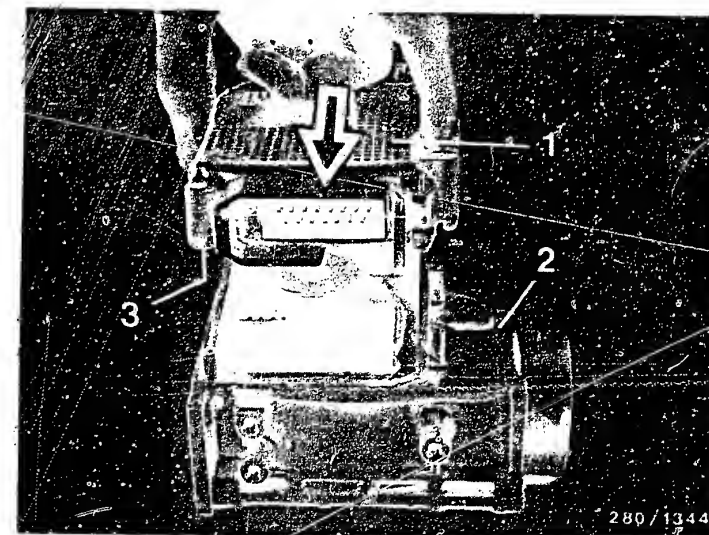
Connect 15-pin plug and latch in.

After installing a new air-flow sensor or control unit, perform idle adjustment. See Coordinate D25.



- 1=Latching spring
- 2=15-pin plug
- 3=Anti-tamper cap
- 4=Connecting screws
- Arrow =Pull off control unit vertically

- 1=Control unit
- 2=Air-flow sensor
- 3=Seal ring
- Arrow =Press on control unit vertically, parallel



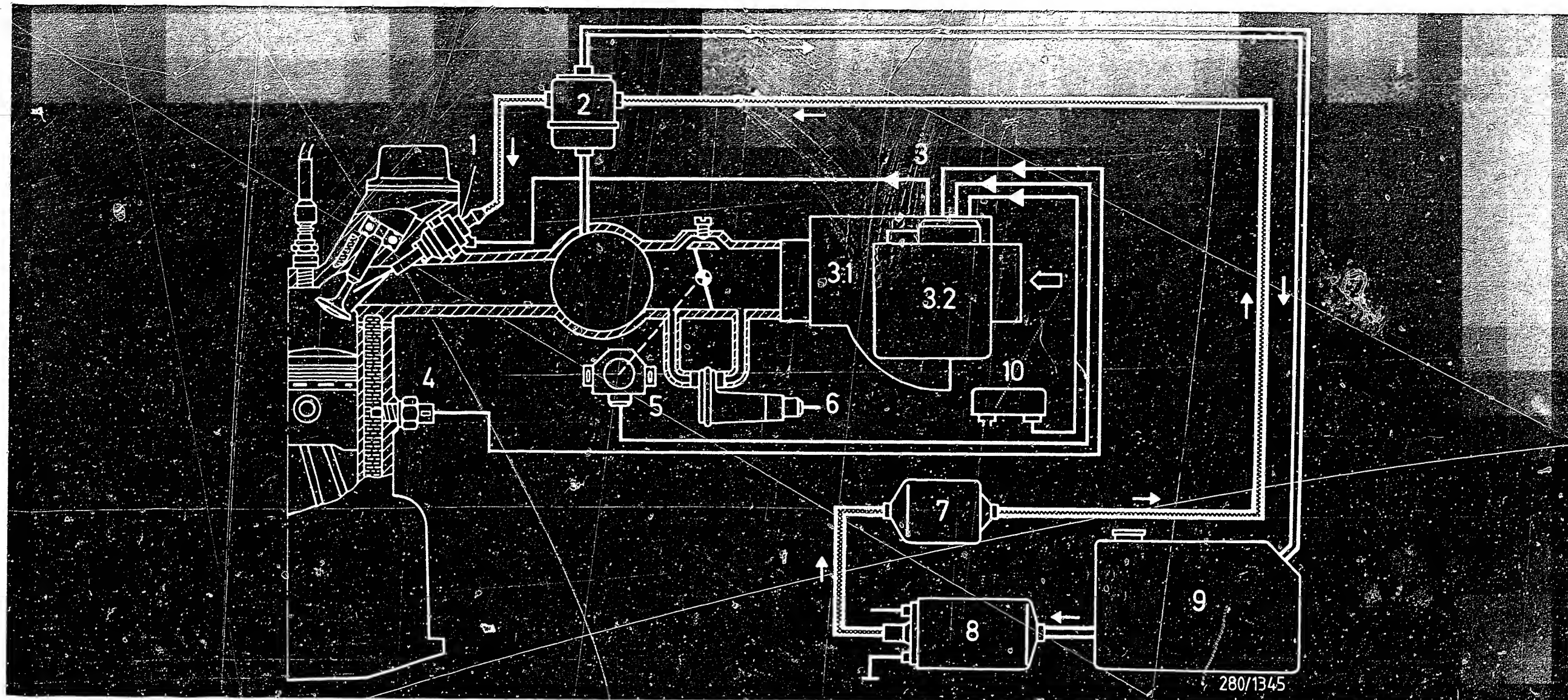


DIAGRAM OF AIR AND FUEL LINES

- 1 = Injection valve
- 2 = Pressure regulator
- 3 = Measuring and control unit
- 3.1 = Air-flow sensor

- 3.2 = Control unit
- 4 = Temperature sensor (engine)
- 5 = Throttle-valve switch
- 6 = Auxiliary-air device

- 7 = Fuel filter
- 8 = Electric fuel pump
- 9 = Fuel tank
- 10 = Pressure sensor (altitude pickup)

———— = Fuel pressure

- - - - - = Pressureless

When trouble-shooting, bear in mind that additional systems/components, such as brake booster, central locking or vacuum-controlled headlight vertical aim control, may be connected to the intake manifold and may thus represent additional sources of faults.

## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on coordinate B03 and contains customer complaints (fault symptoms) with several possible causes (component faults) in each case as well as coordinate references for detailed trouble-shooting. If no coordinate reference is given, this is a cause for which no test instructions are required.

Components that are checked by the self-diagnosis or with the universal test adapter are not listed in the trouble-shooting chart.

If the customer complaint is clear, proceed with trouble-shooting in the given order of possible causes one after the other and step by step.

Always start trouble-shooting with the self-diagnosis (if applicable) or with the universal test adapter (if provided). Only then continue with the trouble-shooting chart.

If the customer complaint is not clear, check all the causes listed in the trouble-shooting chart. To prevent possible incorrect measurements, check all causes in the order given (owing to the interlinking of test steps).

## HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING PROGRAM (continued)

The TROUBLE-SHOOTING PROGRAM contains all system and component checks mentioned in the trouble-shooting chart. It is divided into three rows of boxes.

The left-hand column contains test instructions and set values.  
The center column contains instructions on trouble-shooting and fault rectification.  
The right-hand column contains the illustrations/terminal diagrams belonging to the text, with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.  
After rectifying a fault repeat the test as a check.

### REQUIREMENTS FOR TESTING:

- Battery fully charged
- Engine in good mechanical condition (e.g. compression, valve clearance etc.)
- Engine at operating temperature, approx. +80°C (where necessary)
- Proper seating of all plug connections of wiring harness
- Ignition system O.K.

## TROUBLE-SHOOTING CHART

## Customer complaint (fault symptom)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine knocking/pinging.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)	Coord.
*	*	*	*	*	*	*		*		Universal test adapter	B05
*	*	*	*		*					Air-intake system	C17
*	*	*	*							Auxiliary-air device	C19
*		*	*	*	*	*				Air-flow sensor	C23
				*	*					Fuel delivery	D01
*	*	*	*		*	*	*			Fuel pressure, leaks	D03
		*								Pump noises	D11
		*		*	*	*	*			Injection valves	D13
				*						Alternator, interference suppression	D15
*	*	*				*				Cold-start control	D19
				*		*				Overrun cutoff	D21
		*	*	*		*				Engine-speed, CO adjustment	D25

**B03**

$$\Rightarrow \quad \leftarrow$$

## HOW TO USE THE TEST CHART FOR THE UNIVERSAL TEST ADAPTER

- \* Before testing, check all multiple plug-in connections for loose contacts.
- \* Clean plug-in contacts if dirty or corroded.
- \* Check for blade receptacles that have been pushed back. If necessary, bend back locking lug and press receptacle as far as it will go into plug housing; locking lug latches.
- \* Suspicion of line breaks (positive and negative leads) in case of kinking and pinching.

Connect adapter lead.

The tests cover the peripherals and, where applicable, also the control unit. To take readings, connect to the universal test adapter a multimeter for voltage and resistance measurements and/or a motortester. The test must always be performed completely, starting at test step 1, in the order given.

**TEST PROCEDURE:**

1. The individual test steps build on one another.  
Example: If, in one test step, the ground connection for the control unit is tested, this test is not repeated again in the further test steps.
2. If, in one test step, the set value is not obtained, this test step must be repeated after the fault has been rectified.

**Note:**

In the following test steps, the passages with an additional frame around them show which operation has to be changed compared with the preceeding test step.

**B04**

=====



**Component/function:**  
Connect peripherals only.  
Resistance of temperature sensor (engine)

**\* Operation:**

Position	Position
Progr. switch "V"	=>
Progr. switch "Ω"	5
Test button	—

**\* Measuring equipment:**  
Motortester or multimeter

**\* Measuring range:**  
approx. 5 k Ω or 500 Ω

**\* Connection:**  
Blue test sockets, ohm

**\* Operation in vehicle:**  
Not applicable

**\* Set value:**  
at ambient temperature  
+15°...+30°C:  
1.45...3.3 k Ω

with engine at operating temp.  
approx. +80°C:  
280...360 Ω

Is measured value within  
set-value tolerance?

N>

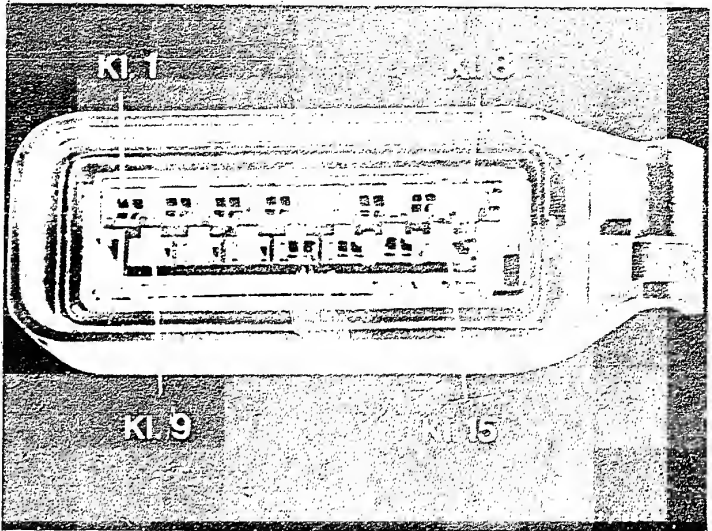
**Trouble-shooting:**  
For testing, disconnect control-unit plug from test adapter.

Measure resistance directly at temperature sensor (engine).  
Ambient temperature +15°...30°C  
Set value: 1.45...3.3 k Ω with engine at operating temp. approx. +80°C  
Set value: 280...360 Ω  
If set set values are not obtained => replace temperature sensor.

Check the following leads for continuity with ohmmeter, set value approx. 0 Ω :

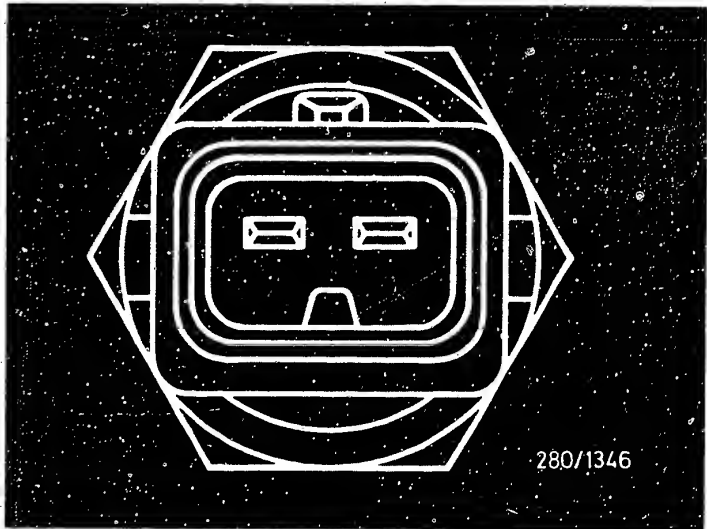
- \* From control-unit plug term. 8 to temperature sensor (engine)
- \* From control-unit plut term. 5 to temperature sensor (engine)

Eliminate open circuits/contact resistances.



Top view of control-unit plug

Top view of connector of engine-temperature sensor





Component/function:

Ground connection of output stage.

N&gt;

* Operation:	Position
Progr. switch "V"	==>
Progr. switch "Ω"	6
Test button	—

\* Measuring equipment  
Motortester or multimeter

\* Measuring range:  
x 10 Ω

\* Connection:  
Blue test sockets, ohm

\* Operation in vehicle:  
Not applicable

\* Set value:  
0...10 Ω

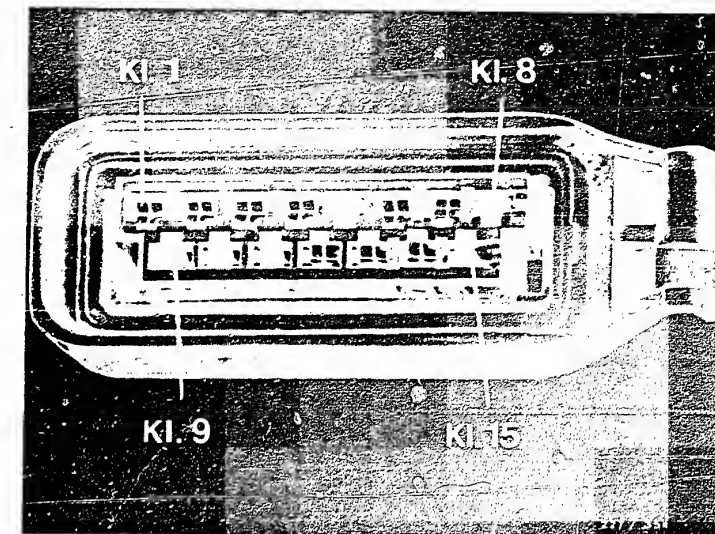
Is measured value within  
set-value tolerance?

Trouble-shooting:

For testing, disconnect control-unit plug.

Check the following leads  
for continuity with ohmmeter,  
set value approx. 0 Ω :

- \* From control-unit plug  
term. 4 to vehicle ground.
- \* From control-unit plug  
term. 5 to vehicle ground.  
Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Continued on next coordinate

Component/function:

Connection of multiplicative map adjustment

* Operation:	Position
Progr. switch "V"	==>
Progr. switch "Ω"	7
Test button	—

N&gt;

\* Measuring equipment  
Motortester or multimeter

\* Measuring range:  
x 10 Ω

\* Connection:  
Blue test sockets, ohm

\* Operation in vehicle:  
Connect lead from term. 6 to ground.

\* Set value:  
0...10 Ω

Is measured value within  
set-value tolerance?

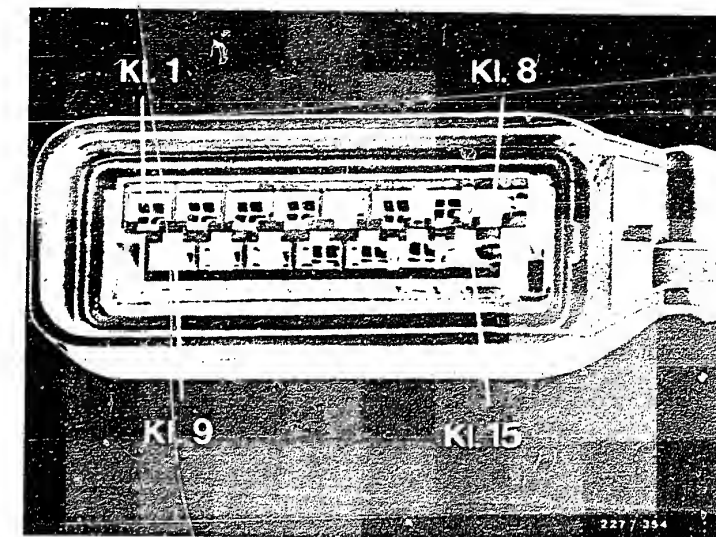
Trouble-shooting:

For testing, disconnect  
control-unit plug.

Check the following lead  
for continuity with ohmmeter,  
set value approx. 0 Ω :

From control-unit plug  
term. 6 to end of lead.

Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Continued on next coordinate

## Component/function:

Resistance of throttle-valve switch (idle)

* Operation:	Position
Progr. switch "V"	=>
Progr. switch "Ω"	9
Test button	—

N&gt;

\* Measuring equipment  
Motortester or multimeter

\* Measuring range:  
x 10 Ω

\* Connection:  
Blue test sockets, ohm

\* Operation in vehicle:  
Accelerator in rest pos.

\* Set value:  
0...10 Ω

\* Operation in vehicle:  
Accel. slightly depressed

\* Set value:  
Infinity Ω

Is measured value within  
set-value tolerance?

Continued on next coordinate

## Trouble-shooting:

Requirement: throttle valve is correctly adjusted.

It must come up against the adjusting screw with the lever just before it sticks.

Secure against turning.

- \* Adjust throttle cable/linkage so that it is free of tension.
- \* If kinked => replace.

For testing, disconnect  
control-unit plug from test  
adapter.

Adjustment of throttle-valve switch

Loosen fastening screws  
slightly. Connect ohmmeter  
to throttle-valve switch  
between term. 2 and term. 18.

Turn throttle-valve switch  
until the idle contact closes  
(microswitch clicks audibly).

Reading 0 Ω . If not =>  
replace throttle-valve switch.

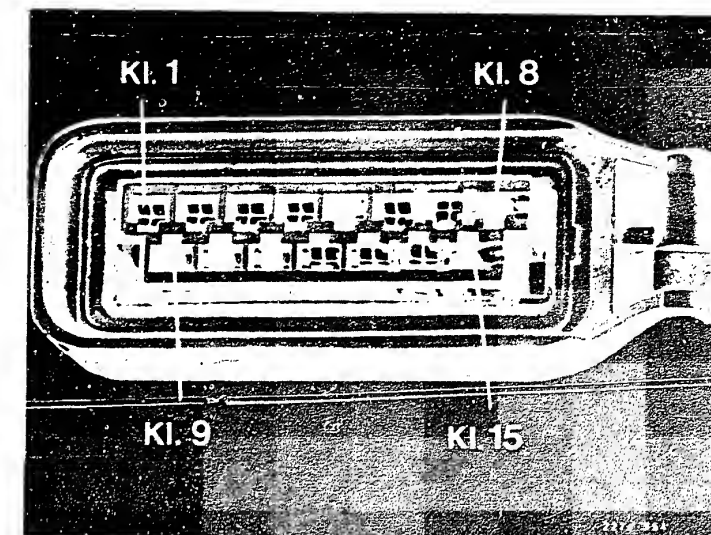
Checking the adjustment:

Pull slightly on throttle  
cable. The idle contact opens  
(microswitch clicks audibly).

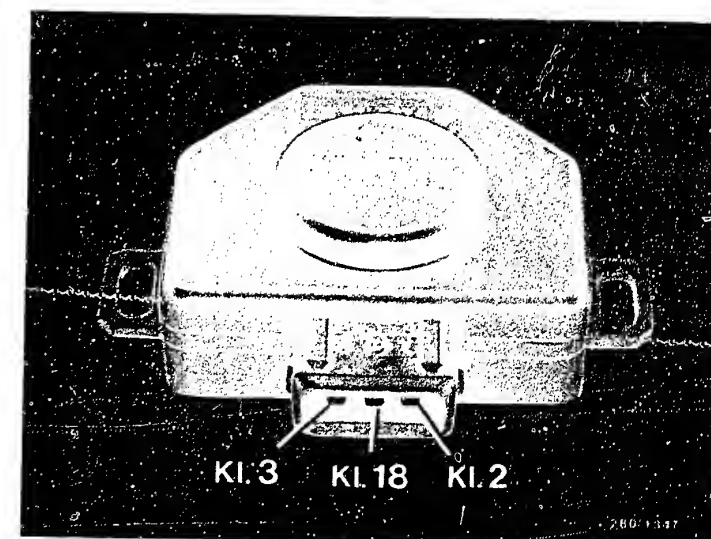
Reading: infinity Ω .

Check the following leads for  
continuity with ohmmeter,  
set value approx 0 Ω :

- \* From throttle-valve switch  
term. 2 to control-unit  
plug term. 15
- \* From throttle-valve switch  
term. 18 to vehicle ground.  
Eliminate open circuits/  
contact resistances.



Top view of control-unit plug



Component/function:

Resistance of throttle-valve switch (full load)

* Operation:	Position
Progr. switch "V"	==>
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment  
Motortester or multimeter

\* Measuring range:  
x 10 Ω

\* Connection:  
Blue test sockets, ohm

\* Operation in vehicle:  
Accel. fully depressed

\* Set value (reading):  
0...10 Ω

\* Operation in vehicle:  
Accelerator in rest pos.

\* Set value (reading):  
Infinity Ω

Is measured value within  
set-value tolerance?

Y

V

Continued on next coordinate

Trouble-shooting:

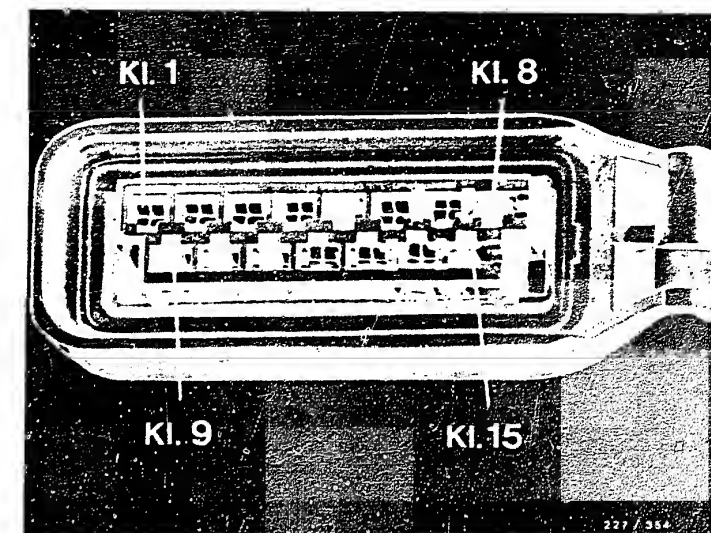
For testing, disconnect  
control-unit plug from  
test adapter.

Measure resistance directly  
at throttle-valve switch at  
term. 3 and term. 18.  
Accelerator fully depressed.  
Set value: approx. 0 Ω  
Accelerator in rest position  
Set value: infinity Ω  
If set values not obtained  
=> replace throttle-valve  
switch.

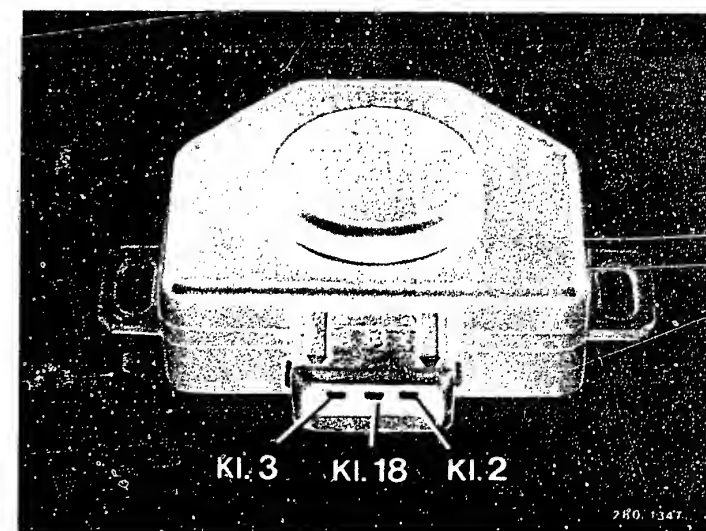
Check the following leads  
for continuity with ohmmeter,  
Set value approx. 0 Ω :

\* From control-unit plug  
term. 14 to throttle-valve  
switch term. 3.

Eliminate open circuits/  
contact resistances.



Top view of control-unit plug



Component/function:

Signal from term. 1 or TD of ignition system. Energization of control unit.

\* Operation:

	Position
Progr. switch "V"	5
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment:

Ignition oscilloscope

\* Measuring range:

Special input  
Ctrl. lever at 1-hd. stop  
Measuring range 20 V

\* Connection:

Test wells

\* Operation in vehicle:

Ignition "on" and start

\* Set values (reading):

Ignition pulses/rectangular pulses

Pulses present?

Trouble-shooting:

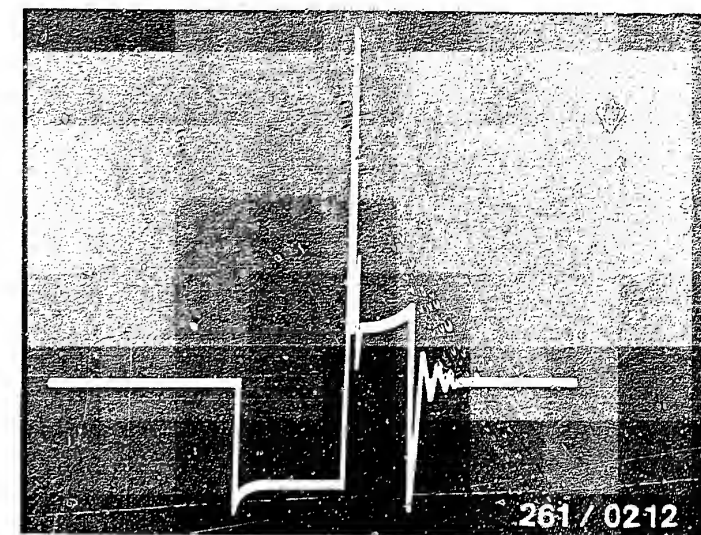
For testing, disconnect control-unit plug from test adapter.

Check the following leads for continuity with ohmmeter, Set value approx. 0 Ω :

- \* From control-unit plug term. 1 to ignition coil term. 1
- \* In case of TD signal, from control-unit plug term. 1 to ignition control unit.

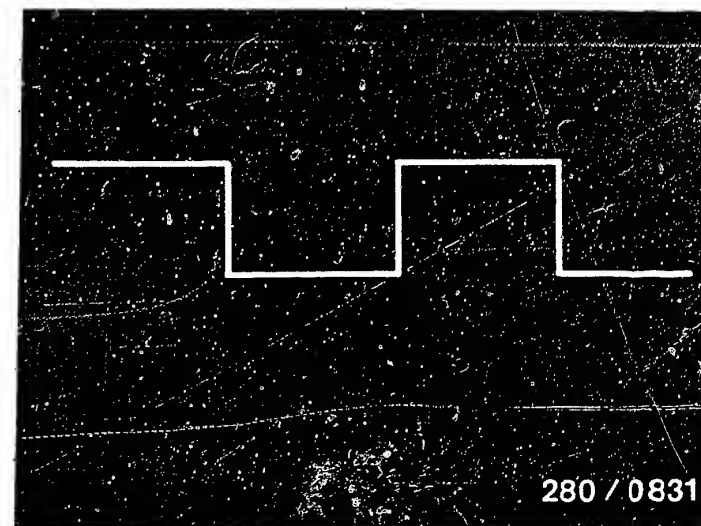
If leads O.K., check ignition system.

Eliminate open circuits/  
contact resistances.



Term. 1 signal from term. 1  
ignit. coil (primary signal)

TD signal from ignition  
trigger box.



Continued on next coordinate



Component/function:

Power supply to control unit.

N&gt;

* Operation:	Position
Progr. switch "V"	6
Progr. switch "Ω"	10
Test button	—

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
approx. 20 V

\* Connection:  
Red test socket (+)  
Black test socket (-)

\* Operation in vehicle:  
Ignition "ON"

\* Set value (reading):  
8...15 V

Is measured value within  
set-value tolerance?

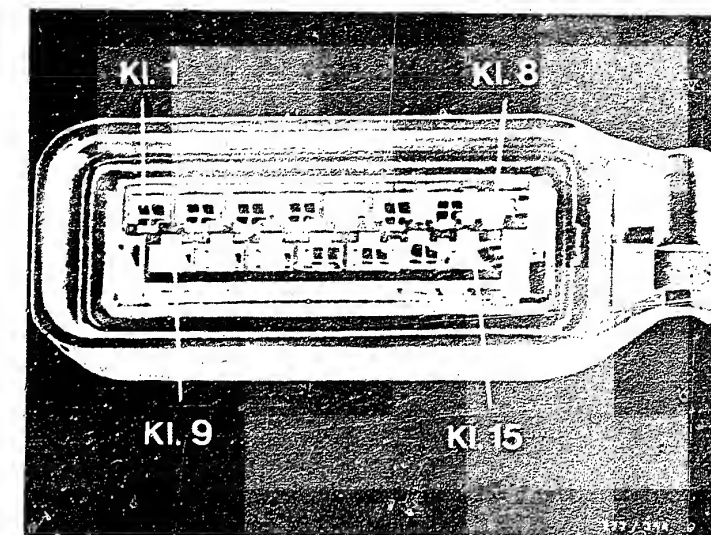
Trouble-shooting:

For testing, disconnect  
control-unit plug from test  
adapter. Remove main  
relay from plug-in base.

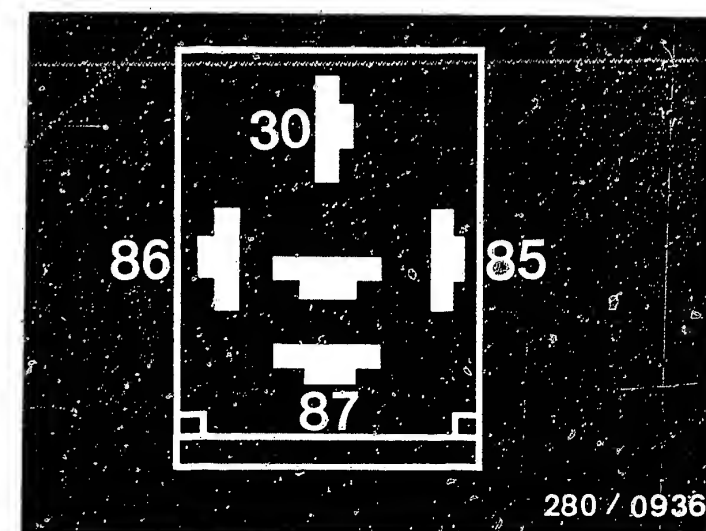
Check the following lead  
for continuity with ohmmeter,  
set value approx. 0 Ω :

- \* From control-unit plug  
term. 2 to main relay term. 87
- \* Voltage supply at main relay  
term. 86 against term. 85  
With ignition "on": 8...15V  
If not, check lead term. 86  
to term. 15 (ignition/starting  
switch) and ignition/starting  
switch.
- \* Check lead term. 85 to  
vehicle ground.
- \* Voltage at main relay term. 30  
against term. 85: 8...15V  
If not, check lead term. 30  
to battery (+).
- \* Connect main relay in plug-  
in base.  
With ignition "on": relay  
must pull in.  
If not => replace main relay.

Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Top view of connection  
base.

Continued on next coordinate

# TEST STEP 8

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

## Component/function:

Winding and power supply (+)  
of pump relay.

* Operation:	Position
Progr. switch "V"	7
Progr. switch "Ω"	10
Test button	—

N>

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
approx. 20 V

\* Connection:  
Red test socket (+)  
Black test socket (-)

\* Operation in vehicle:  
Ignition "ON"

\* Set value (reading):  
8...15 V

Is measured value within  
set-value tolerance?

## Trouble-shooting:

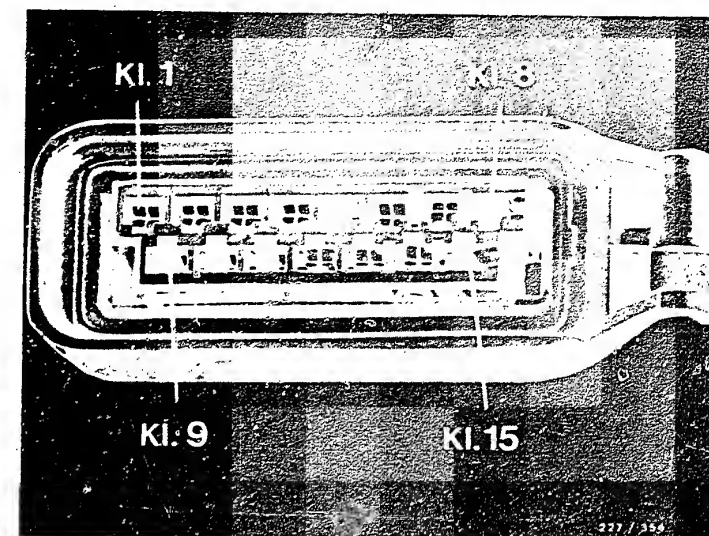
For testing, disconnect  
control-unit plug from test  
adapter.

Check the following leads  
for continuity with ohmmeter,  
Set value approx. 0 Ω :

- \* From control-unit plug  
term. 12 to pump relay  
term. 85
- \* From pump relay term. 86  
to main relay term .87

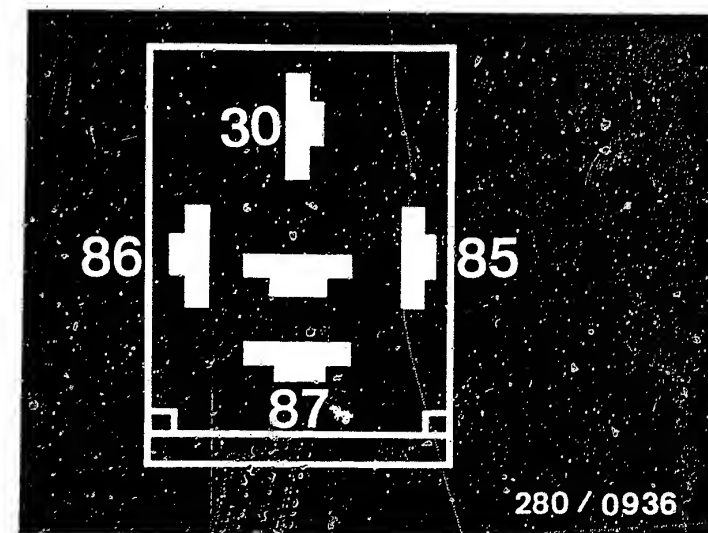
If leads O.K. => replace  
pump relay.

Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Top view of connection  
base.



Continued on next coordinate

Component/function:

Connect control unit also.  
Simulation of energization of  
electric fuel pump

N&gt;

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	3

\* Measuring equipment: —

\* Measuring range: —

\* Connection: —

\* Operation in vehicle:

Disconnect plug from  
auxiliary-air device.  
Ignition "on"

\* Set value (reading):

Electric fuel pump must  
operate, listen

Electric fuel pump  
operating?

Trouble-shooting:

For testing, disconnect  
control-unit plug from test  
adapter.

Measure voltage at pump  
relay term. 30 to vehicle  
ground.

Set value: 8...15V

If not, check the following  
leads for continuity with  
ohmmeter

Set value approx. 0 Ω

\* Check lead term. 30 from  
pump relay to battery for  
continuity.

If lead O.K. => replace  
pump relay.

Measure voltage directly  
at electric fuel pump.

Connect test adapter.

Press test button 3.

Set value: 8...15 V

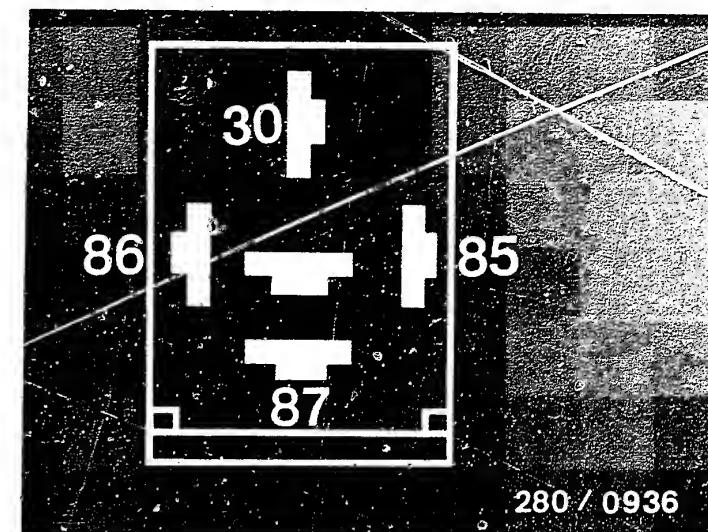
If not, check the following  
leads for continuity with  
ohmmeter

Set value approx. 0 Ω

\* From electric fuel pump to  
pump relay term. 87.

\* From electric fuel pump to  
vehicle ground.

If leads O.K. => replace  
electric fuel pump.



Top view of connection  
base.

Continued on next coordinate

Component/function:

Connect control unit also.  
Simulation of auxiliary-air device

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	3

\* Measuring equipment:  
Mirror

\* Measuring range: —

\* Connection:  
Red test wells (+)  
Black test wells (-)

\* Operation in vehicle:  
Connect plug of  
auxiliary-air device.  
Ignition "on"

\* Set value (reading):  
Plate must close air  
cross section.

Is measured value within  
set-value tolerance?

N>

Trouble-shooting  
Disconnect hoses and look  
down auxiliary-air device  
(possibly using a small  
mirror).

Press test button 3:  
Plate must close slowly.  
If not, measure voltage  
at plug of auxiliary-air  
device.

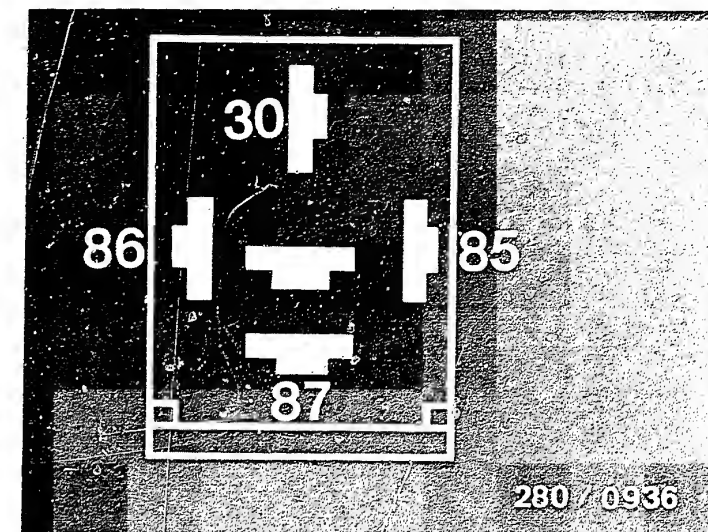
Press test button 3.  
Set value: 8...15V

If not, check the following  
leads for continuity

Set value approx. 0 Ω :

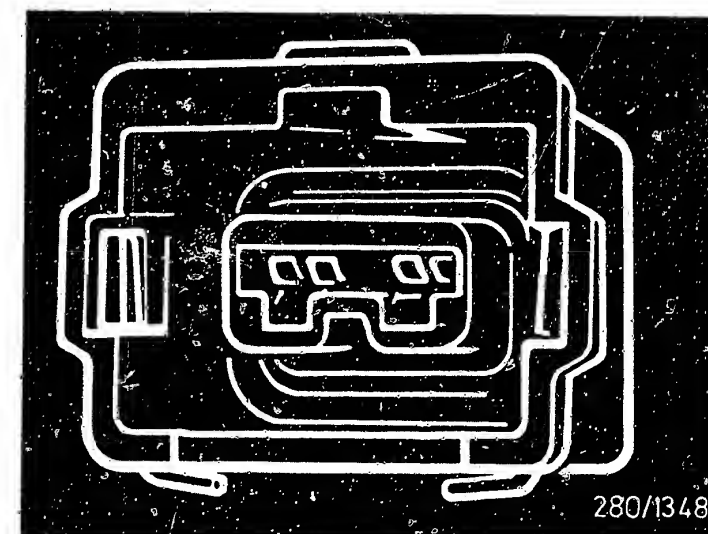
- \* From plug of auxiliary-air  
device to ground.
- \* From plug of auxiliary-air  
device to pump relay term. 87

If leads O.K. => replace  
auxiliary-air device.  
Eliminate open circuits/  
contact resistances.



Top view of connection  
base.

Connector of auxiliary-air  
device.



Continued on next coordinate

Component/function:

Connect control unit also.  
Ground energization of pump  
relay through control unit

* Operation:	Position
Progr. switch "V"	7
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
approx. 20 V

\* Connection:  
Red test socket (+)  
Black test socket (-)

\* Operation in vehicle:  
Let engine run.

\* Set value (reading):  
0...5V

Is measured value within  
set-value tolerance?

Trouble-shooting:

Pump relay must pull in when  
starting.

If not => replace control  
unit.

See also Coordinate  
A17

Eliminate open circuits/  
contact resistances.

Continued on next coordinate



## TEST STEP 11

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

Component/function:

Connect control unit also.  
Air-flow signal at Up output

* Operation:	Position
Progr. switch "V"	8
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
approx. 10 V

\* Connection:  
Red test socket (+)  
Black test socket (-)

\* Operation in vehicle:  
Let engine run

\* Set value (reading):  
0...5V load-dependent

Is measured value within  
set-value tolerance?

\* Trouble-shooting:

For testing, disconnect  
control-unit plug from test  
adapter.

The air-flow sensor must  
be tested separately.  
To do this, the control  
unit must be removed.

See also Coordinate  
A17

Test air-flow sensor:  
Resistance between term. 3  
and term. 4.

Set value: 500...1000 Ω

Resistance between term. 3  
and term. 2

Air-flow sensor flap in  
rest position

Set value: 10...200 Ω

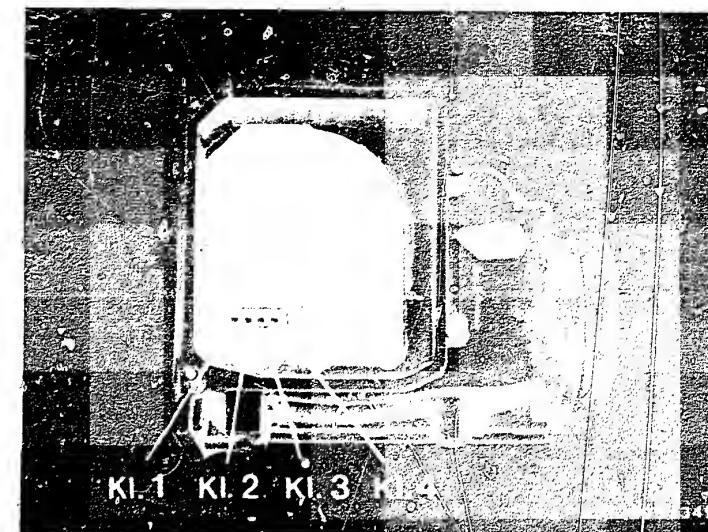
If a set value is not obtained  
=> replace air-flow sensor.

If set value obtained =>  
replace control unit.

See also Coordinate

A17

Eliminate open circuits/  
contact resistances.



Continued on next coordinate

# TEST STEP 12

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

## Component/function:

Connect control unit also.  
Potentiometer voltage of  
altitude pickup.

* Operation:	Position
Progr. switch "V"	9
Progr. switch "Ω"	10
Test button	—

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
approx. 20 V

\* Connection:  
Red test socket (+)  
Black test socket (—)

\* Operation in vehicle:  
Let engine run

\* Set value (reading):  
at 980 mbar (300m): 2...4 V  
at 615 mbar (4000m): 8...12 V

Is measured value within  
set-value tolerance?

N>

## Trouble-shooting:

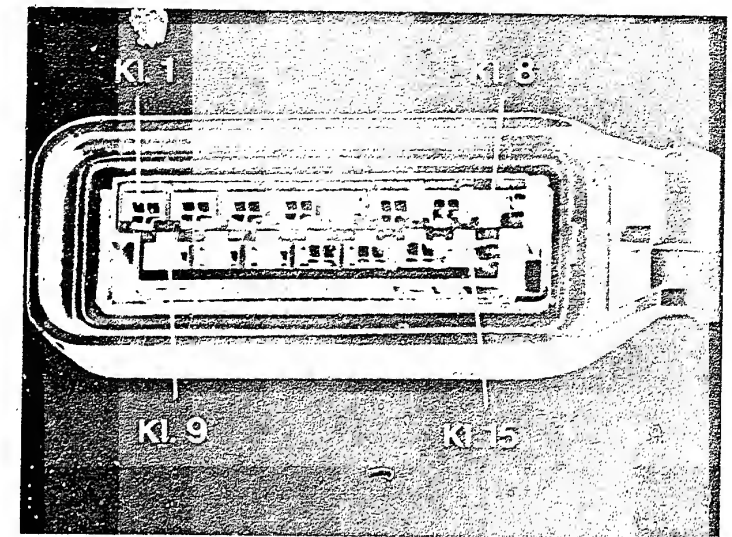
For testing, disconnect  
control-unit plug from test  
adapter.

Measure resistance directly  
at altitude pickup.  
between term. 2 and term. 3:  
Set value: 2.3...2.8 k Ω  
between term. 2 and term. 1:  
Set value: 2.0...2.7 k Ω

If set values not obtained  
=> replace altitude pickup.

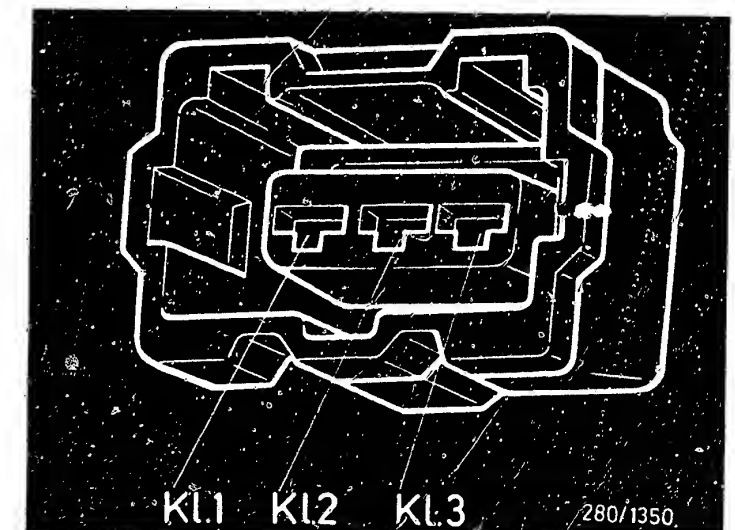
Check the following leads  
for continuity with ohmmeter  
(set value approx. 0 Ω):

- \* From altitude pickup term. 1  
to control-unit plug term. 7
- \* From altitude pickup term. 3  
to main relay term. 87.
- \* From altitude term. 2 to  
vehicle ground.  
Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Top view of plug of altitude  
pickup



Continued on next coordinate

C01

<=>

C02

<=>

Component/function:

Connect control unit also.  
Injection pulses from control unit.

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	—

\* Measuring equipment:  
Motortester, oscilloscope

\* Measuring range:  
Special input 20 V

\* Connection:  
Red test wells (+)  
Black test wells (-)

\* Operation in vehicle:  
Let engine run

\* Set value (reading):  
Injection pulses at oscilloscope

Are injection pulses visible?

N&gt;

Trouble-shooting:

For testing, disconnect control-unit plug from test adapter.

Resistance between control-unit plug term. 3 and pump relay term. 87

Set value:

4-cyl. engine: 3.5...5.0 Ω

6-cyl. engine: 2.2...3.5 Ω

If set value not obtained, measure resistances of injection valves individually.

Set value: 14.5...17 Ω

If set value not obtained  
=> replace injection valve.

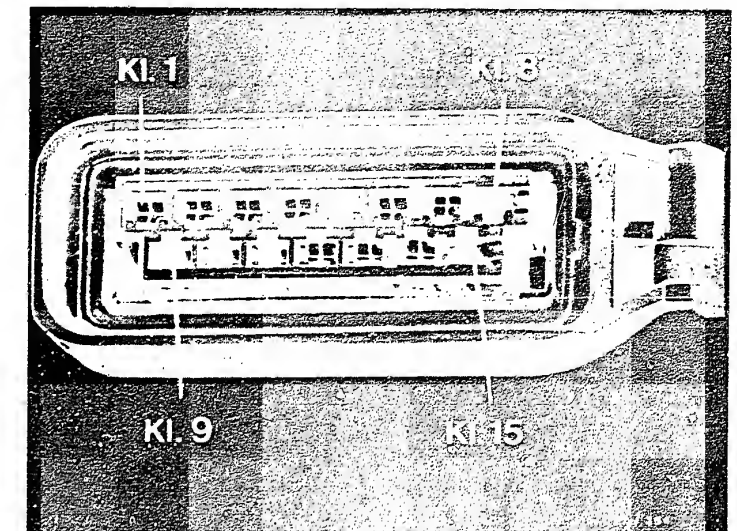
If set value obtained, check the following leads for continuity with ohmmeter.

Set value approx. 0 Ω

\* From control-unit plug term. 3 to the individual connectors of the injection valves.

\* From pump relay term. 87 to the individual connectors of the injection valves.

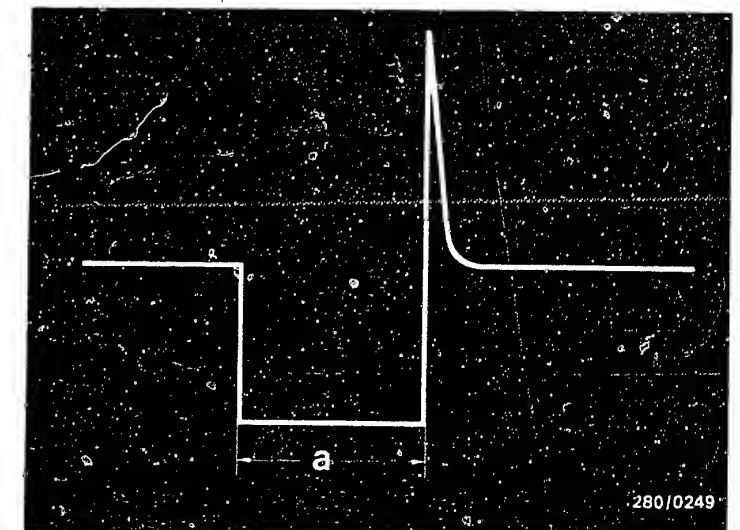
If leads O.K. => replace defective control unit.  
See also Coordinate A17  
Eliminate open circuits/contact resistances.



Top view of control-unit plug

Injection pulses of a switched output stage (measured at the injection valve)

a = Pulse length (dependent on engine load)



Continued on next coordinate

## TEST STEP 14

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

Component/function:

Connect control unit also.  
Load signal (TL output)

* Operation:	Position
Progr. switch "V"	11
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment:  
Motortester, oscilloscope

\* Measuring range:  
Special input 10 V

\* Connection:  
Red test wells (+)  
Black test wells (-)

\* Operation in vehicle:  
Let engine run

\* Set value (reading):  
TL pulses (rectangular pulses)  
load-dependant

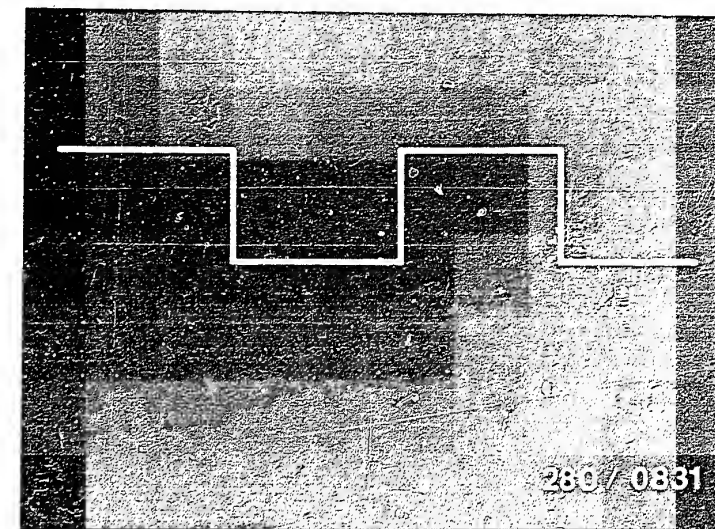
Are pulses visible?

Trouble-shooting:

Disconnect any loads from  
control-unit plug term. 10.  
If set value now obtained  
=> check loads.

If set value not obtained  
=> replace control unit.

See also Coordinate A17



Continued on next coordinate

C05

&lt;=&gt;

C06

&lt;=&gt;

Component/function:

Connect control unit also.  
Reference voltage (UV output)

* Operation:	Position
Progr. switch "V"	12
Progr. switch "Ω"	10
Test button	—

N&gt;

\* Measuring equipment:  
Motortester or multimeter

\* Measuring range:  
Special input 10 V

\* Connection:  
Red test sockets (+)  
Black test sockets (—)

\* Operation in vehicle:  
Let engine run

\* Set value (reading):  
3.5...4.5 V

Is measured value within  
set-value tolerance?

Trouble-shooting:

For testing, disconnect  
control-unit plug from  
test adapter.

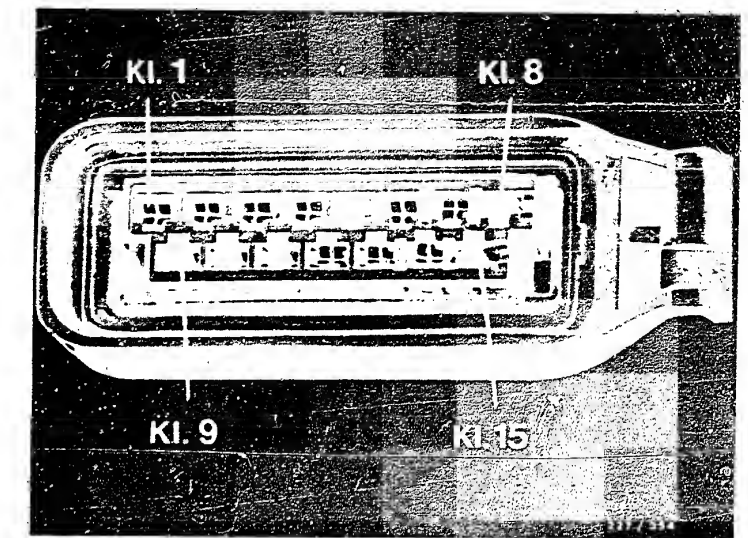
Disconnect the loads (e.g.  
ignition control unit)  
connected to control unit  
term. 9.

Measure shielded lead at  
control unit term. 9 to  
vehicle ground.

Set value: infinity Ω

Is set value now obtained?  
If yes → check loads.  
If not → replace defective  
control unit.  
See also Coordinate A17

Eliminate open circuits/  
contact resistances.



Top view of control-unit plug

Continued on next coordinate



## TEST STEP 16

( TEST SPECIFICATIONS AND NOTES ON OPERATION )

Component/function:

Connect control unit also.  
Simulation of cold engine

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	1

\* Measuring equipment:  
Motortester, oscilloscope

\* Measuring range:  
Special input 20 V

\* Connection:  
Red test wells (+)  
Black test wells (-)

\* Operation in vehicle:  
Let engine run

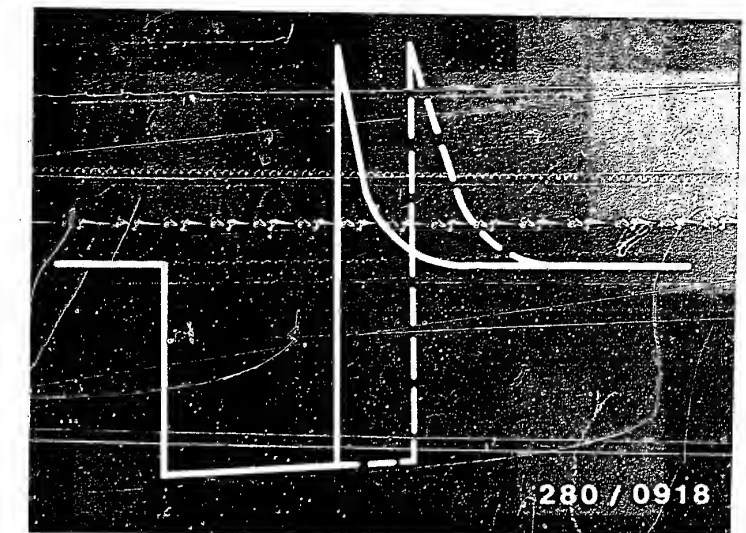
\* Set value (reading):  
Injection pulse must become  
wider, or engine speed must  
drop.

Does injection pulse  
become wider?

Trouble-shooting:

If set value not obtained  
=> replace control unit.

See also Coordinate A17



Wider injection signal  
after pressing button T 1

Continued on next coordinate

## TEST STEP 17

## ( TEST SPECIFICATIONS AND NOTES ON OPERATION )

V

Component/function:

Connect control unit also.  
Simulation of warm engine

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	2

N&gt;

\* Trouble-shooting:

If set value not obtained  
=> replace control unit.

See also Coordinate A17

\* Measuring equipment:

Motortester, oscilloscope

\* Measuring range:

Special input 20 V

\* Connection:

Red test wells (+)

Black test wells (-)

\* Operation in vehicle:

Let engine run

\* Set value (reading):

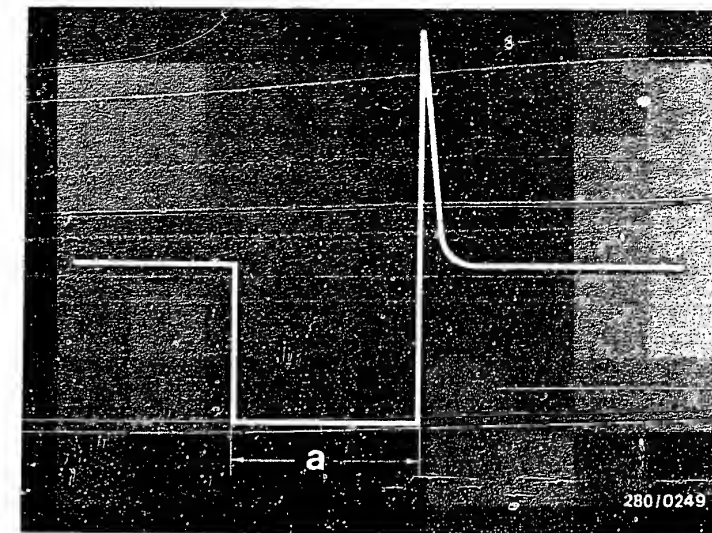
Injection pulse must not  
become wider

Does injection pulse  
remain the same?

Y

V

Continued on next coordinate



Injection pulses of a switched  
output stage (measured at the  
injection valve)  
a = Pulse length (dependent  
on engine load)

V

Component/function:  
Connect control unit also.  
Simulation of overrun cutoff

\* Operation:

	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	5

\* Measuring equipment:

Motortester, oscilloscope

\* Measuring range:

Special input 20 V

\* Connection:

Red test wells (+)  
Black test wells (-)

\* Operation in vehicle:

Engine speed above  
2000 min-1

\* Set value (reading):

Injection pulse stops/engine  
hunts

Do injection pulses stop?

N>

Trouble-shooting:

If set value not obtained  
=> replace control unit

See also Coordinate A17

V

Continued on next coordinate

C13

<=>

C14

<=>

Component/function:

Connect control unit also.  
Simulation of full-load enrich.

* Operation:	Position
Progr. switch "V"	10
Progr. switch "Ω"	10
Test button	6

N&gt;

\* Measuring equipment:

Motortester, oscilloscope

\* Measuring range:

Special input 20 V

\* Connection:

Red test wells (+)

Black test wells (-)

\* Operation in vehicle:

Engine speed above  
2000 min<sup>-1</sup>

\* Set value (reading):

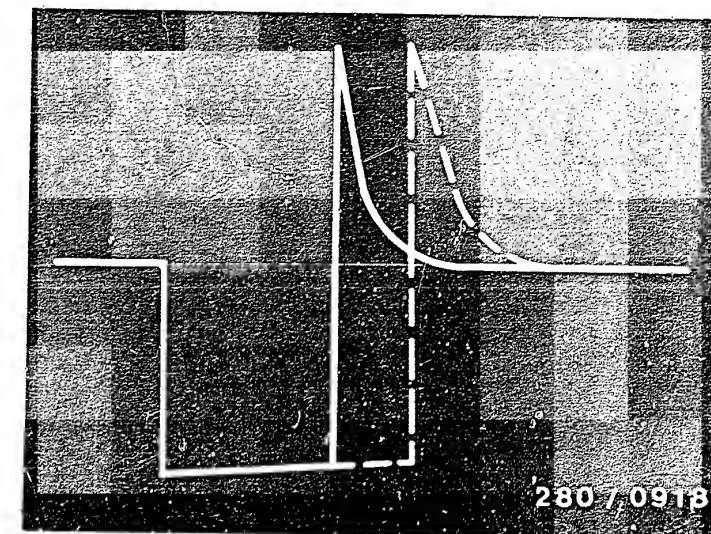
Slight change in injection  
pulse/engine speed.

Change in pulse/engine  
speed?

Trouble-shooting:

If set value not obtained  
=> replace control unit

See also Coordinate A17



Changed injection signal  
after pressing button T 6.

Continued on next coordinate

# TROUBLE-SHOOTING PROGRAM ( 1 )

## Check air-intake system

Are all hoses correctly connected, not kinked or damaged?  
Is oil dipstick pressed all the way in? Is lid seal on oil filler neck O.K.?

Are all hoses O.K.?

N>

Replace hoses if necessary.  
Re-tighten hose binders.

Push in oil dipstick firmly.  
Replace lid seal on oil filler neck.

## Leak test

Seal off exhaust tail pipe.  
Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.  
Remove hose after auxiliary-air device and seal off connection port on auxiliary-air device.  
Fully open throttle valve.

Using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.  
Spray or brush all joints with leak-detector spray or soapy water.

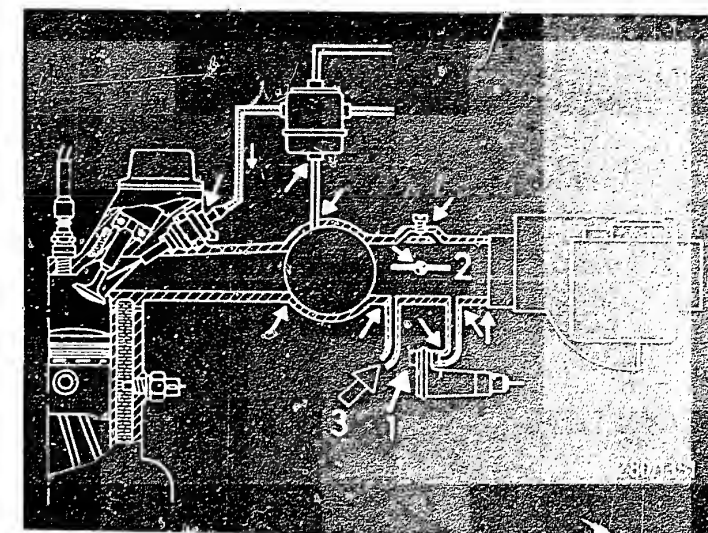
Are all joints leak-tight?

N>

Bubbling or foaming indicates a leak.

Eliminate leaks by new seals or by re-tightening the hose binders.

Leaks may also occur at the following points:  
Throttle-valve mounting, intake-manifold gasket as well as auxiliaries (e.g. brake booster) that work on intake-manifold pressure.



1 = Sealing  
2 = Open throttle valve fully  
3 = Blow in air  
Small arrows = Possible leaks

Return to trouble-shooting chart  
B01



## TROUBLE-SHOOTING PROGRAM ( 2 )

### Check auxiliary-air device

With engine cold:  
Pinch off hose to auxiliary-air device. Engine speed must drop.

With engine warm:  
Pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. Do not damage hose.

Visual examination: disconnect hose and look down (possibly using a small mirror and lamp). With the engine cold, the cross section must be partially open; when the engine is warm, it must be closed.

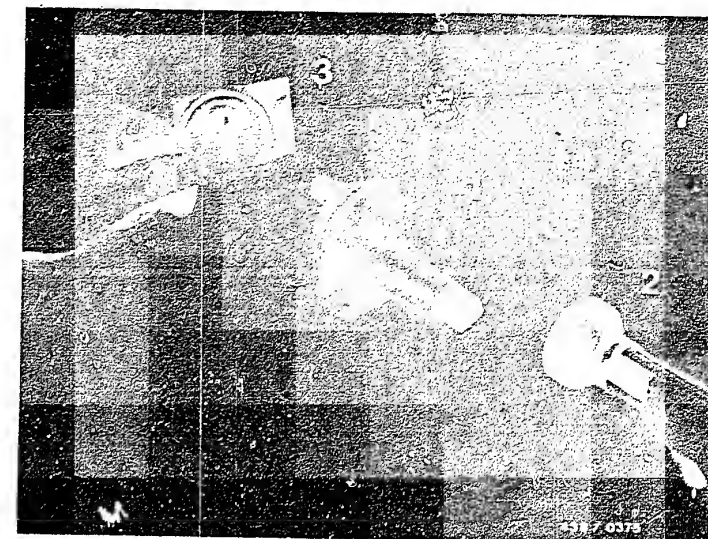
Functions obtained?

Replace auxiliary-air device

Disconnect connector from auxiliary-air device.  
Measure resistance directly at auxiliary-air device  
Set value: see brief instructions  
Set value obtained?

Replace auxiliary-air device

Continued on next picture page



- 1 = Auxiliary-air device
- 2 = Hand lamp
- 3 = Mirror

TRUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 1 )

After testing is finished

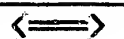
Connect hoses on auxiliary-air  
device.

Make sure there are no leaks.

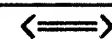
Connect connector on auxiliary-  
air device.

Return to trouble-shooting chart  
B01

C21



C22



# TROUBLE-SHOOTING PROGRAM ( 3 )

V

Check air-flow sensor for freedom of movement

N>

Unlatch 15-pin plug and remove. Remove measuring and control unit from air-filter housing and loosen air hose. It must be possible for the air-flow sensor flap to be moved with uniform ease from stop to stop; when released, the flap must close again by itself.

Sensor flap must not catch. Watch for signs of abrasion or rubbing. If very dirty, clean air duct with lint-free cloth.

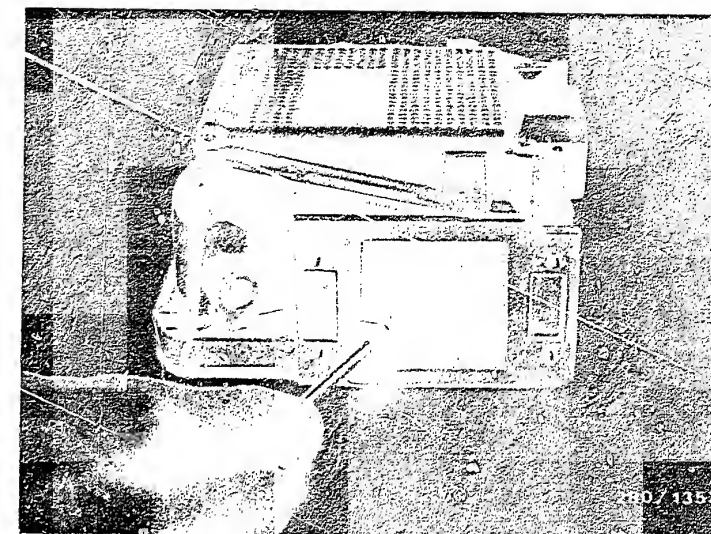
Does air-flow sensor flap move freely?

Y

V

Continued on next picture page

If there are signs of rubbing visible in the housing, if air-flow sensor flap is sticking or bent => replace air-flow sensor. To do this, remove control unit for further use. See also Coordinate A17



Deflect air-flow sensor flap

TROUBLE-SHOOTING PROGRAM ( 3 ) CONTINUED ( 1 )

Electrical test of air-flow sensor.

To do this, remove control unit from air-flow sensor.  
See also Coordinate A17

Check potentiometer:  
Connect ohmmeter to term. 3 and term. 4 of air-flow sensor.  
Set value: 500...1000  $\Omega$

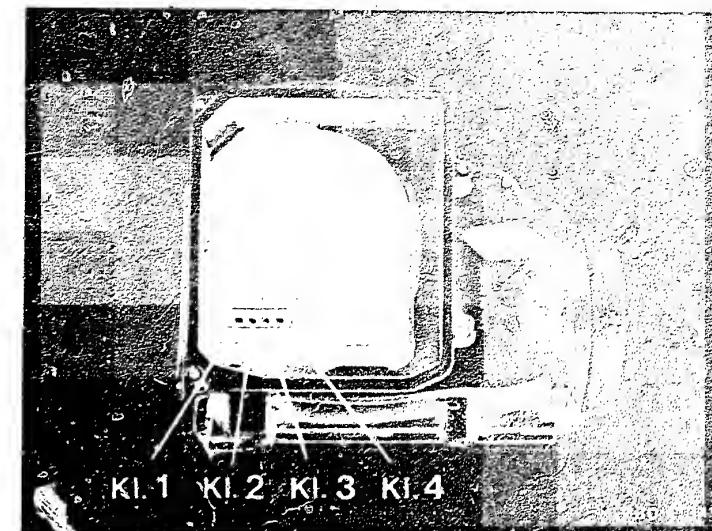
Resistance between term. 3 and term. 2, sensor flap in rest position  
Set value: 10...200  $\Omega$   
The reading must change when the sensor flap is deflected.

Check temperature sensor (intake-air):  
Resistance between term. 3 and term. 1.  
Set values:  
at ambient temperature,  
+15...+30 °C: 1.45...3.3 k  $\Omega$   
with engine at operating temp.  
approx. + 80° C : 280...360  $\Omega$

Set values obtained?

N>

Potentiometer or temperature sensor (intake-air) defective  
=> replace air-flow sensor.  
To do this, remove control unit for further use.  
See also Coordinate A17



Continued on next picture page

TROUBLE-SHOOTING PROGRAM ( 3 ) CONTINUED ( 2 )

↓

Mount control unit on air-flow sensor.

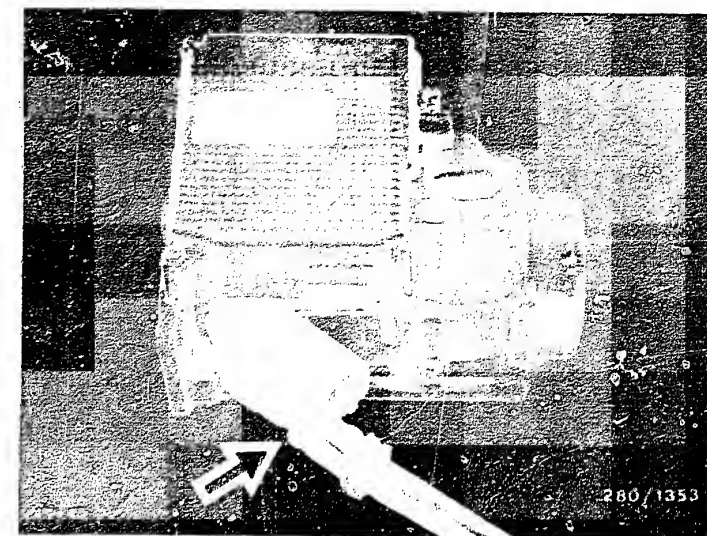
See also Coordinate A17

Screw measuring and control unit onto air-filter housing and mount air-guide hose. Connect 15-pin plug and latch in.

After installing a new air-flow sensor, perform idle adjustment. See Coordinate D25

↓

Return to trouble-shooting chart B01





# TROUBLE-SHOOTING PROGRAM ( 4)

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5 l measuring glass. Disconnect pump relay. Connect jumper into connection base between term. 87 and term. 30. The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery  
SET VALUE: See brief instructions

Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Return to trouble-shooting chart B01

N>

\*Fuel filter very dirty  
→ replace.

\*Fuel delivery line or pressure damper (if applicable) clogged → replace.

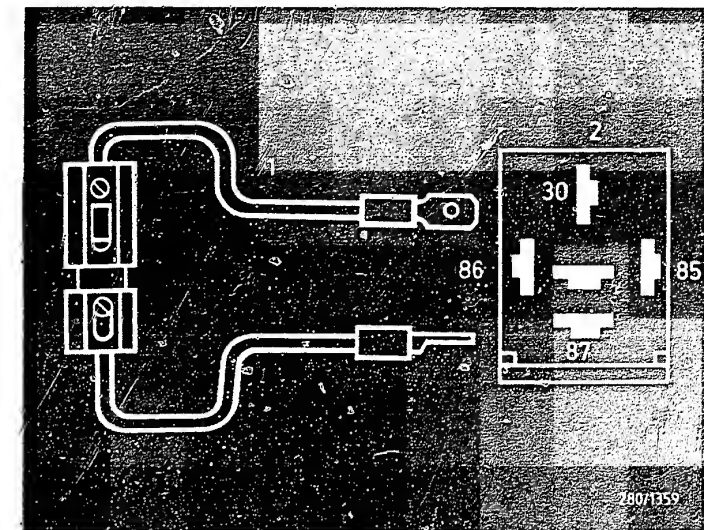
\*Voltage at electric fuel pump, with engine running, min. 12 V. If not, clean contacts, eliminate poor ground connection, replace leads.

\*Check pre-supply pump (if applicable). Measuring point: line between the pumps. Fuel delivery must be at least 10% greater than that of the electric fuel pump. If not → replace pre-supply pump.

\*If fuel-pump delivery too low → replace electric fuel fuel pump. Clean joints before loosening so that no dirt gets into the fuel system. In-tank electric fuel pumps are accessible via a closure on the tank.

\*If electric fuel pump loud (vapor locks) intake line constricted or kinked → replace. Strainer in tank clogged → replace. Corrosion in tank → clean/replace.

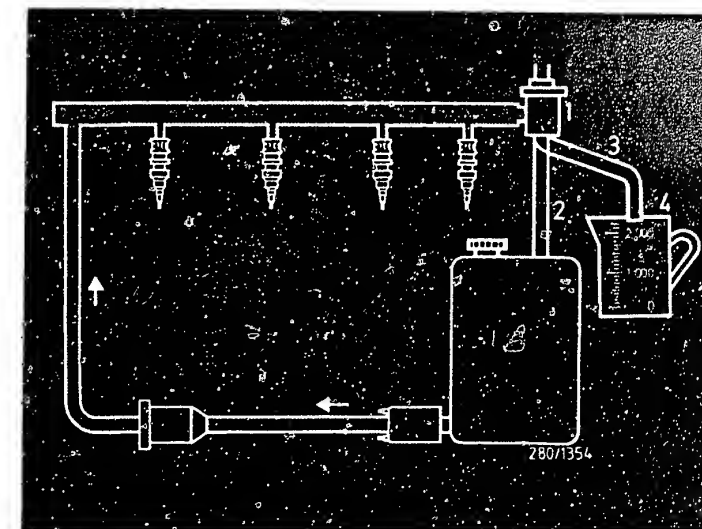
\*Pressure regulator defective - check. See next coordinate:



1 = Jumper with fuse holder and 10 A fuse (user-fabricated)  
2 = Top view of connection base

Pressureless

Fuel pressure  
1 = Pressure regulator  
2 = Return  
3 = Test hose  
4 = Measuring glass



Check fuel pressure with engine stopped.

N&gt;

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

CAUTION!

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5). Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

### Set value not reached:

\*Slowly pinch off fuel return line.  
Caution: pressure must not rise above 6 bar.  
If pressure rises above 5 bar → replace pressure regulator.  
In case of O ring sealing, use new O rings. Lightly grease with silicone grease (Ft 2 v 1).  
Pressure does not rise sufficiently: fuel pump defective.

\*Fuel filter very dirty  
→ replace.

\*Fuel delivery line or pressure damper (if applicable) clogged  
→ replace.

\*Strainer in tank clogged.  
Corrosion in tank.

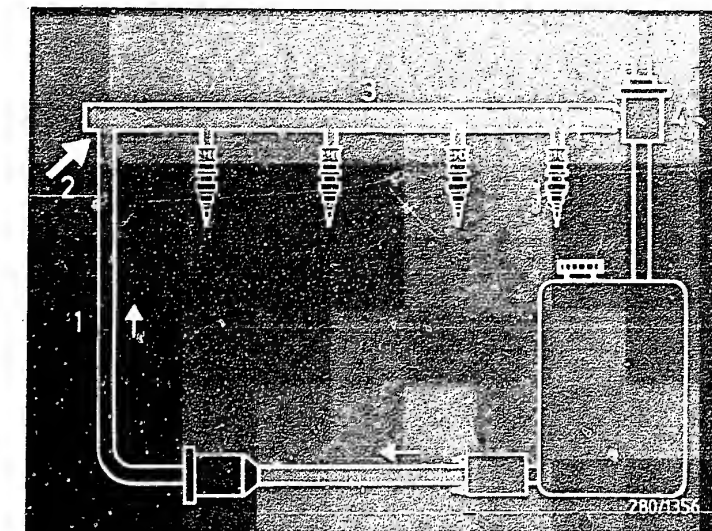
### Set value exceeded:

Loosen fuel return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5l measuring glass.

Is set value now obtained?

\*If yes, fuel return line clogged or pinched → replace.

\*If not, pressure regulator defective → replace.

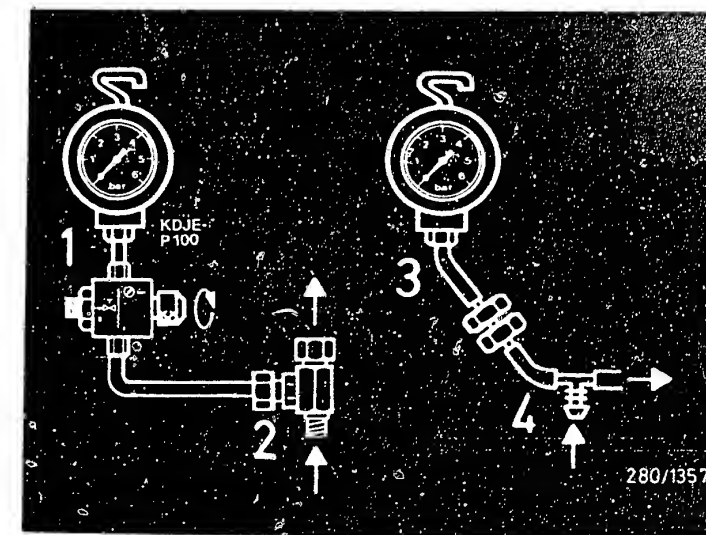


————— Pressureless

----- Fuel pressure

1 = Inlet, delivery line  
2 = Measuring point  
3 = Fuel-distribution pipe  
4 = Pressure regulator

1 = Pressure tester  
2 = Connec. part KDJE-P100/14  
3 = Pressure gauge with hose line  
4 = Three-way line KDJE-P100/13



Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 5 ) CONTINUED ( 1 )

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure  
SET VALUE: approx. 0.5 bar  
lower than with engine stopped.

Set value obtained?

N>

\*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking -> replace.  
Hose line dropped off -> re-connect.

\*If intake-manifold-pressure energization O.K. -> replace pressure regulator.

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure  
SET VALUE: min. 1.0 bar  
after 20 minutes.

Set value obtained?

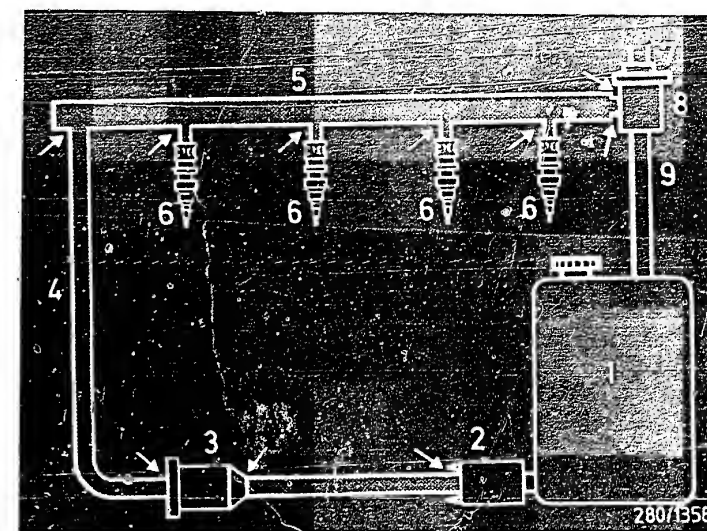
N>

\*Leaking at joints between components, fuel hoses and fuel lines -> tighten hose binder or replace hose.

\*Pressure regulator (diaphragm) leaking -> replace.

\*Electric fuel pump (non-return valve) leaking.  
With screw-type non-return valve -> replace.  
With integral non-return valve -> replace electric fuel pump.

\*Pressure damper or fuel filter leaking -> replace.



- 1 = Fuel tank
- 2 = Electric fuel pump
- 3 = Fuel filter
- 4 = Inlet, delivery line
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connection
- 8 = Pressure regulator
- 9 = Return line

Arrows = Possible leaks

Continued on next picture page

Continued on next picture page

If set value not obtained:

\*Injection valve(s) leaking at connection to fuel-distribution pipe => replace O-ring. See text below.

\*Check injection valve(s) (needle seat) for leaks:

Remove complete fuel-distribution pipe. Inlet and return remain connected. Withdraw all injection valves simultaneously from intake-manifold guides.

Connect jumper between term. 87 and term. 30 in connection base (pump relay). Electric fuel pump must operate.

Set value:

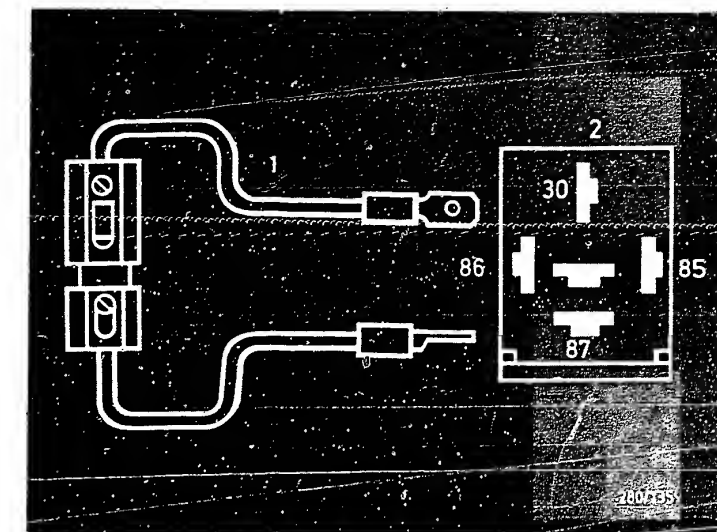
No drop may fall from the injection valve within 60 sec. If incorrect => replace injection valve.

Removal:

Disconnect connector. Withdraw holding clamp. Pull out injection valve.

Caution:

Catch escaping fuel. It must not get onto hot parts of the engine.



1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base

1 = Fuel-distribution pipe

2 = Holding clamp

3 = Upper O-ring

4 = Part number

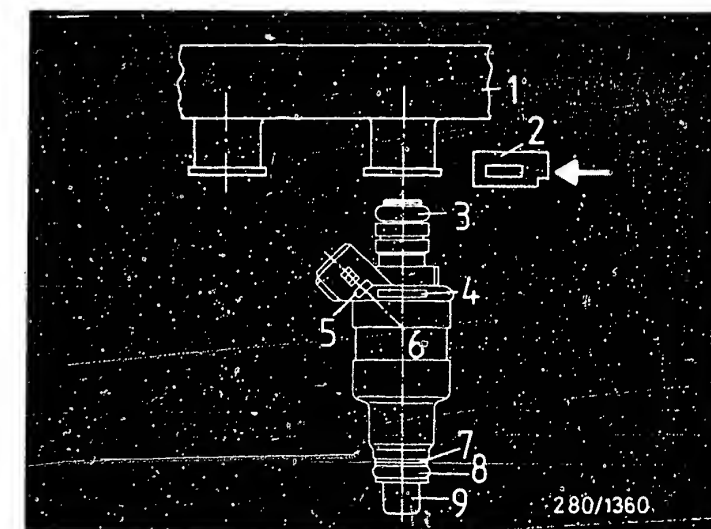
5 = FD mark

6 = Injection valve

7 = Supporting plate

8 = Lower O-ring

9 = Protective sleeve



Continued on next picture page

Continued on next picture page

If injection valve (needle seat) leak-tight, but O-ring defective => replace O-ring.

Use parts set 1 287 010 704.  
Warning: Do not damage protective sleeve or valve needle.

If upper O-ring (fuel-distribution pipe) is damaged, replace.

If lower O-ring (intake manifold) is defective, cut open. Fit new O-ring over protective sleeve and its bead.

#### Installation:

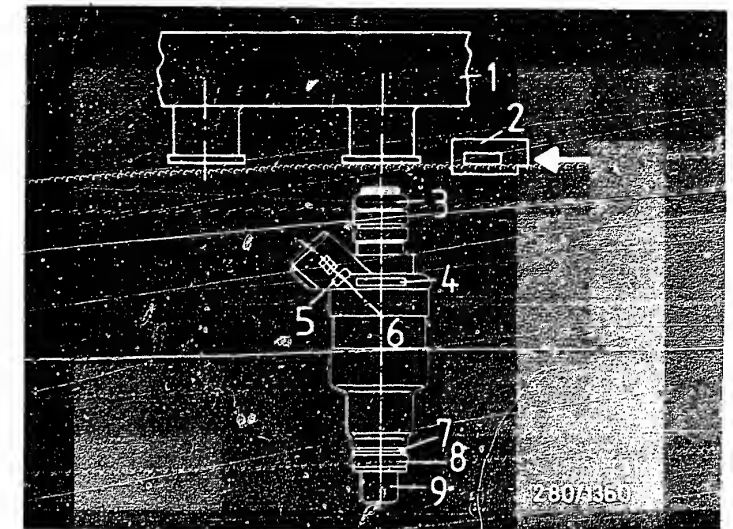
Lightly grease only O-rings (silicone grease Ft 2v 1). Plug injection valve onto fuel-distribution pipe. Insert holding clamp into groove and allow to latch. Check for fuel leaks. Connect connector.

Install complete fuel-distribution pipe, pressing all injection valves simultaneously into intake-manifold guides.

#### Caution:

Do not damage O-rings or valve needles.

Make sure there are no leaks at intake manifold.



- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = FD mark
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.  
Connect fuel-inlet hose to fuel-distribution pipe.  
Make sure there are no leaks.

Return to trouble-shooting chart B01



# TROUBLE-SHOOTING PROGRAM ( 6 )

Increased noise from electric fuel pump.

In case of:

- high outside temperatures,
  - high fuel temperatures,
  - fuel tank almost empty,
  - lengthy full-load driving or
  - at idle,
  - use of winter fuel at warmish outside temperatures,
- vapor locks in the intake line may lead to noises at the electric fuel pump.

Are pump noises normal?

N>

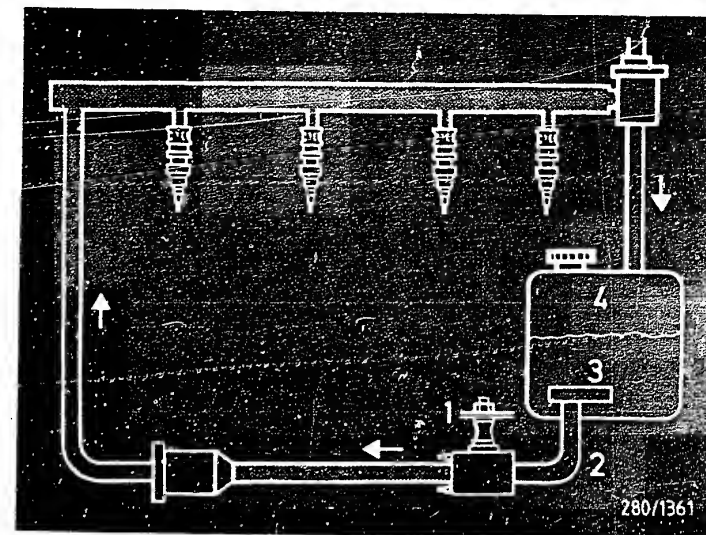
\*Pump suspension (vibration damper) defective -> replace.

\*Intake line constricted or kinked -> replace.

\*Strainer in fuel tank clogged -> replace.

\*Intake or delivery line transmitting pump noises to vehicle body -> lay lines so that they are free of tension, or replace if necessary.

\*If fuel tank almost empty -> fill up.



- 1 = Pump mounting
- 2 = Intake line
- 3 = Intake strainer
- 4 = Fuel level

Return to trouble-shooting chart B01

# TROUBLE-SHOOTING PROGRAM ( 7 )

V

Check solenoid-operated injection valves with engine running.

N>

With engine running, disconnect injection-valve connectors, individually one after the other, from the injection valves and re-connect.

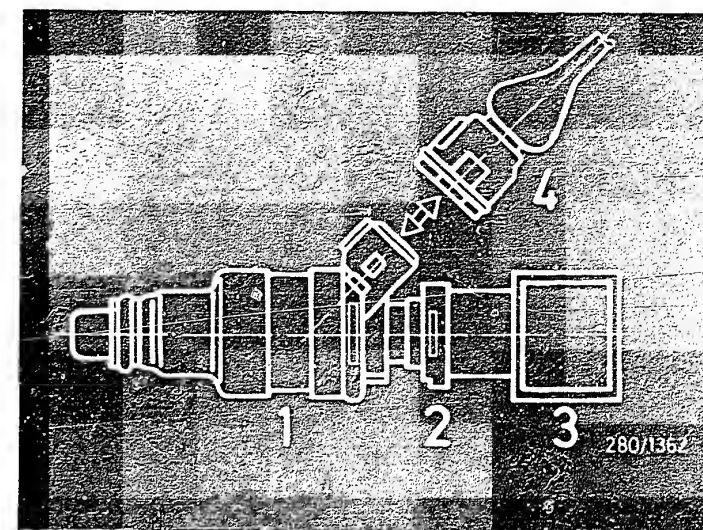
Engine speed must noticeably drop if injection valve is O.K.

Set value: drop in engine speed

Set value obtained?

V

No drop in engine speed =>  
Replace injection valve in question.



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

V

Return to trouble-shooting chart  
BO1

# TROUBLE-SHOOTING PROGRAM ( 8 )

Check interference and missing.

Connect the two-pole test lead 1 684 463 093 between an injection valve and its connector.

Connect motortester (special input) to test lead. Black clamp to vehicle ground. Connect red clamp to one of the two connections of the test lead.

Caution: the free terminal of the test lead must not come into contact with ground.

Let engine run.

If correctly connected, injection pulses will be visible on the oscilloscope (diagram opposite).

Set value: injection pulses

Set value obtained?

N>

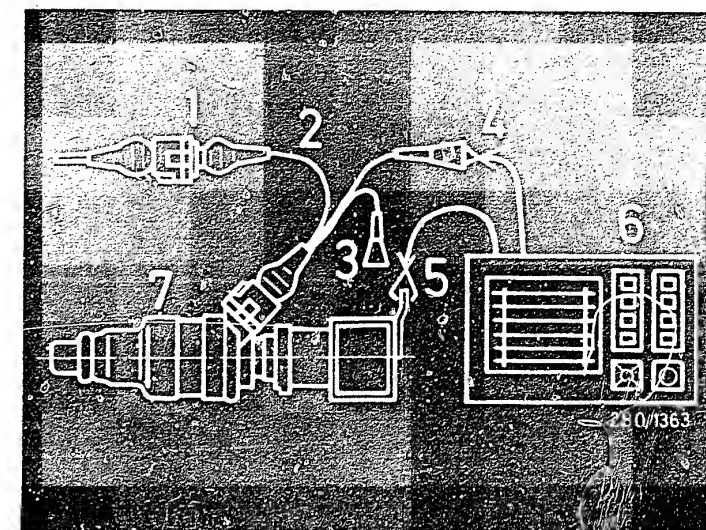
Check connections.  
Connect the red clamp from the motortester to the other connection of the test lead.

The free connection must not come into contact with ground.

If there are deviations from the set value, the other injection valves should also be examined.

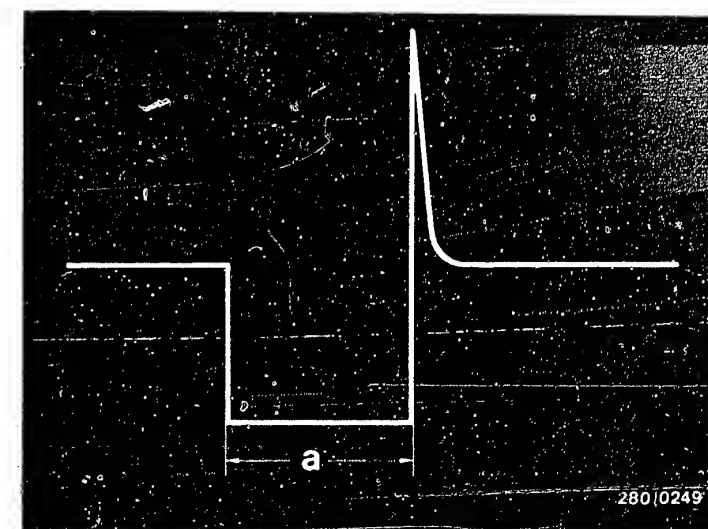
In the case of interference, check the routing of the leads, i.e. ignition cables should be kept clear of the wiring harness.

In the case of missing, check all electrical plug-in connections. Pay particular attention to positive supply, ground connection and ignition signal term. 1



- 1 = Connector
- 2 = Test lead 1 684 463 093
- 3 = Free connection
- 4 = Red clamp
- 5 = Black clamp
- 6 = Motortester
- 7 = Injection valve

Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load)



Continued on next picture page

Continued on next picture page

TROUBLE-SHOOTING PROGRAM ( 8 ) CONTINUED ( 1 )

After testing is finished:

Ignition "OFF". Disconnect  
motortester. Disconnect  
test lead from solenoid-  
operated injection valve and  
connect connector.

With engine off, remove plug  
from alternator.  
Start engine.  
If missing stops, check  
alternator and regulator.  
Voltage peaks are visible  
on the ignition oscilloscope.

Return to trouble-shooting chart  
B01

D17



D18



# TROUBLE-SHOOTING PROGRAM ( 9 )

V

Check cold-start control.

Disconnect ignition lead term. 4 from ignition-distributor cap and connect to vehicle ground with spark gap. Engine must not start.

## Caution:

When using a spark gap, an interference-suppression resistor of at least 2 k  $\Omega$  must be connected between spark gap and ignition coil term. 4, e.g. sleeve-type suppressor (5 k  $\Omega$  ) 0 356 500 001.

Connect 2-pole test lead 1 684 463 093 between a solenoid-operated injection valve and its connecting lead. Connect multimeter to free measuring poles. Measuring range approx. 10 V. Disconnect plug from temperature sensor (engine) and connect 10 k  $\Omega$  resistor, e.g. temperature sensor 0 280 130 028

(at 15°C...30°C) 10 k  $\Omega$

## MEASUREMENT:

Start engine.

Set value: voltage drops within approx. 15 s cranking time from initially greater than 1,5 V to approx. 0,5 V.

Wait for more than 1 minute before cranking again.

Is set value obtained?

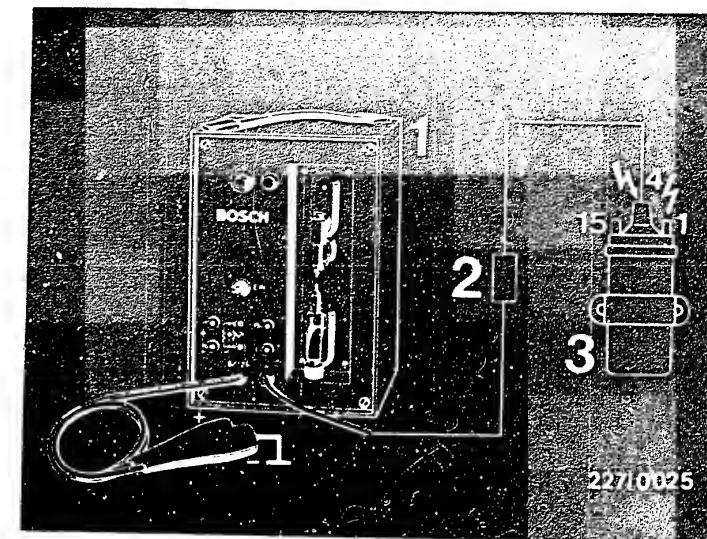
V

V

Return to trouble-shooting chart B01

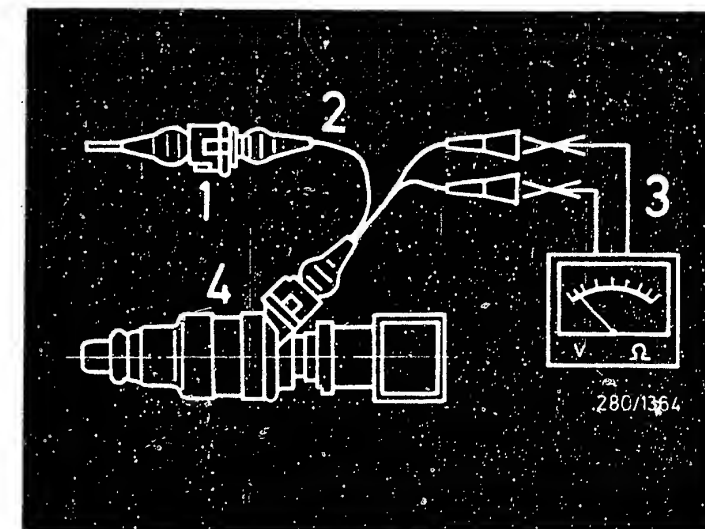
N>

If voltage values not obtained  
=> replace control unit.



- 1 = Spark gap
  - 2 = 5 k  $\Omega$  sleeve-type suppressor
  - 3 = Ignition coil
- (Caution: term. 1 and term. 4: Dangerous voltages 400 V - 25 kV).

- 1 = Connector from vehicle wiring harness
- 2 = Test lead 1 684 463 093
- 3 = Multimeter
- 4 = Injection valve





# TROUBLE-SHOOTING PROGRAM (10)

V

## Check overrun cutoff

Connect the two-pole test lead 1 684 463 093 between a solenoid-operated injection valve and its connector. Connect motortester (special input) to test lead. Black clamp to vehicle ground. Connect red clamp to one of the two connections of the test lead.

Caution: the free connection of the test lead must not come into contact with ground.

Let engine run.

If correctly connected, injection pulses will be visible on the oscilloscope (diagram opposite).

Set value: injection pulses

Set value obtained?

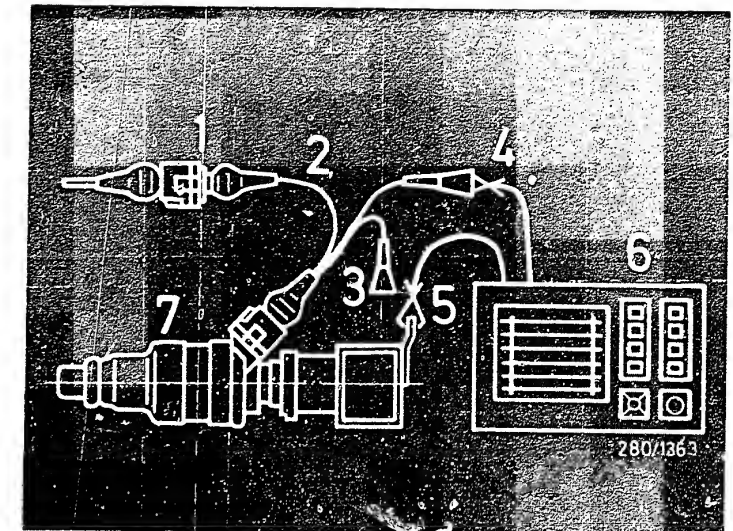
Y

V

N>

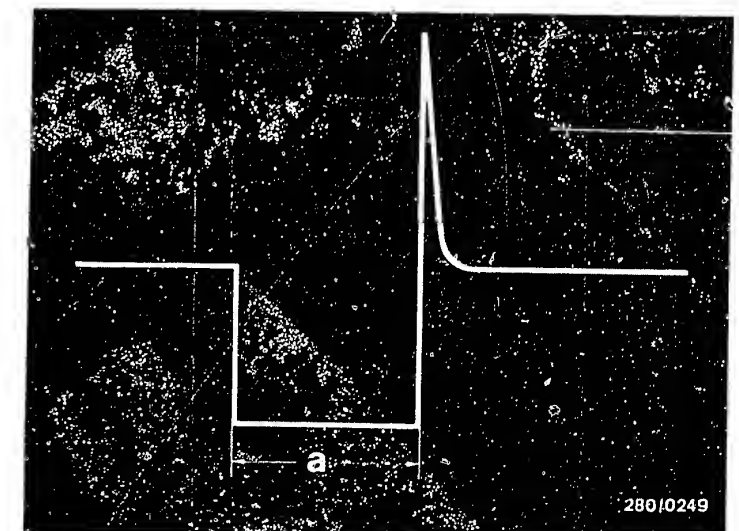
Check connections. Connect the red clamp from the motortester to the other connection of the test lead.

The free connection must not come into contact with ground.



- 1 = Connector
- 2 = Test lead 1 684 463 093
- 3 = Free connection
- 4 = Red clamp
- 5 = Black clamp
- 6 = Motortester
- 7 = Injection valve

Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load)



Continued on next picture page

TROUBLE-SHOOTING PROGRAM (10) CONTINUED ( 1)

Slowly raise engine speed to approx. 3000 min<sup>-1</sup>. Injection pulses must be visible on the oscilloscope. Take foot off accelerator (idle position). There must be no more injection pulses.

Reinstatement speeds:

Engine at ambient temperature +15...+30°C

Set value: see brief instructions

Engine at op. temp. approx. +80°C

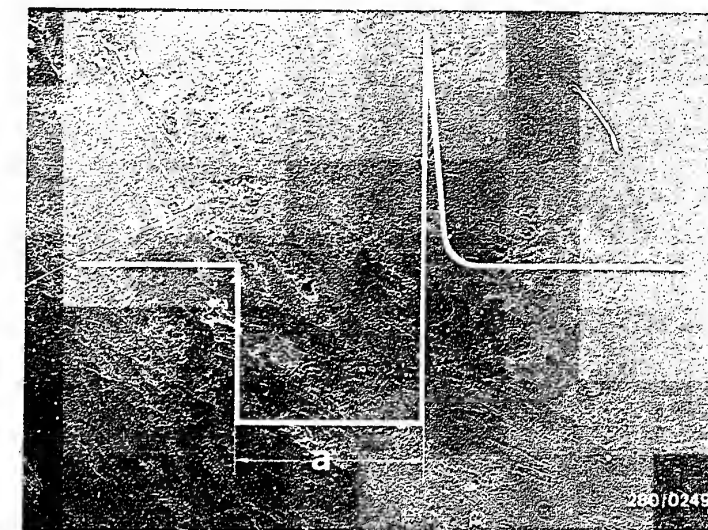
Set value: see brief instructions

Set value obtained?

N>

Make sure that the idle switch has been correctly adjusted and is in proper working order.

If this is the case => replace control unit.



Injection pulses of a switched output stage (measured at the injection valve)  
a = Pulse length (dependent on engine load)

After testing is finished:

Ignition "OFF". Disconnect motortester. Disconnect test lead from solenoid-operated injection valve and connect connector.

Return to trouble-shooting chart B01

# TROUBLE-SHOOTING PROGRAM (11)

Check idle speed

Requirement:

- \*Air-intake system leak-tight.
- \*Air filter not clogged.
- \*Auxiliary-air device leak-tight
- \*Throttle lever resting on stop.
- \*Throttle cable/linkage adjusted free of tension.

\*Ignition and valve gear O.K.

Conditions:

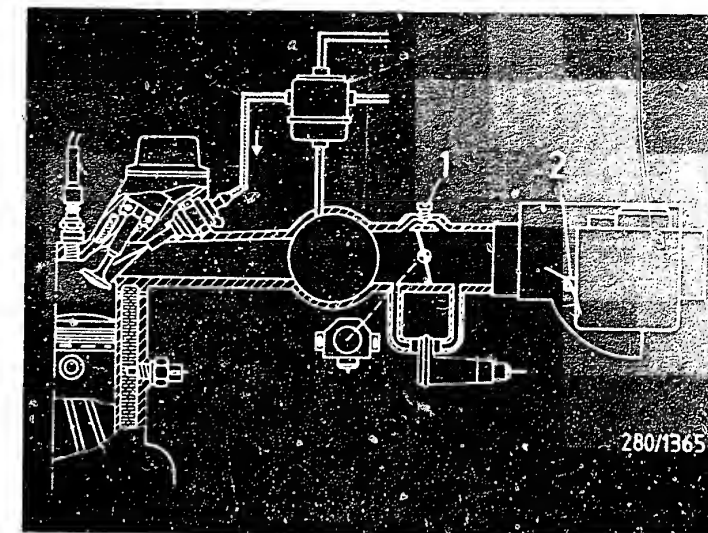
- \*Engine at operating temperature, approx. +80°C
- \*Air conditioner off.

Set value: see brief instructions

Set value obtained?

N>

Adjust idle speed at bypass screw on throttle-valve assembly.



1 = Idle-speed bypass screw

2 = CO adjusting screw

Check CO concentration

Conditions:

- \*Eng. at op. temp., approx.+80°C
- \*Exh. system must be leak-tight.

Set value: see brief instructions

Is set value obtained?

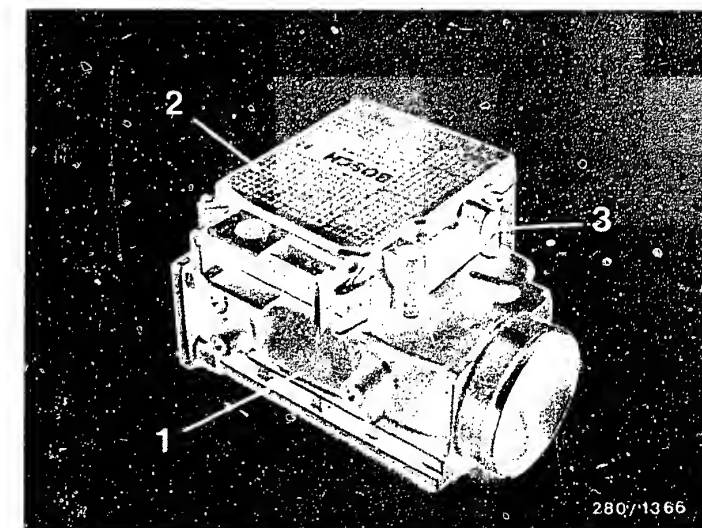
N>

Lever out large anti-tamper cap (on side of control unit).  
Adjust CO concentration according to set value in brief instructions by turning the CO screw.  
Press in new anti-tamper cap No. 1 280 508 010.

1 = Air-flow sensor

2 = Control unit

3 = Anti-tamper cap for CO adjusting screw



Return to trouble-shooting chart B01

## INDEX

Term	Coordinate
Adapter lead	A09
Air-flow sensor, electrical	C25
Air-flow sensor, mechanical	C23
Air-flow signal (Up output)	B27
Air-intake system	C17
Altitude pickup	C01
Auxiliary-air device	B23
CO concentration adjustment	D25
Cold-start control	D19
Control unit	A17
Diagram of air lines	A19
Diagram of fuel lines	A19
Electric fuel pump	B21
Fuel delivery	D01
Fuel filter	D01
Fuel leaks	D05
Fuel pressure	D03
Full-load contact	B13
Full-load enrichment	C15
Ground connection	B07
How to use microcard	A02
How to use trouble-shooting chart	B01
How to use trouble-shooting program	B01
How to use universal test adapter	B04
Idle contact	B11
Idle speed	D25
Ignition signal	B15
Injection pulse	C03
Installation position of components	A13
Intake-manifold pressure energization	D05
Interference	D15
Interference suppression	D15
Leak test	C17
Load signal (TL output)	C05
Measuring and control unit	A17

## Index, continued

Item	Coordinate
Missing	D15
Multiplicative map adjustment	B09
Overrun cutoff	C13
Precautionary measures	A04
Pressure damper	D05
Pressure regulator	D03
Pre-supply pump	D01
Pump noises	D11
Pump relay	B19
Reference voltage (UV output)	C07
Safety measures	A04
Solenoid-operated injection valve	D07/D13
Special features	A03
Temperature sensor (engine)	B05
Temperature sensor (intake-air)	C25
Test chart for universal test adapter	B04
Test conditions	B02
Test equipment	A06
Throttle-valve adjustment	B11
Throttle-valve switch	B11
Tools	A06
Trouble-shooting chart	B03
Trouble-shooting program	C17
Universal test adapter	A08
Voltage supply	B17

## TABLE OF CONTENTS

Section	Coordinate
Structure of this microcard.....	A01
How to use this microcard.....	A02
Special features.....	A03
Safety and precautionary measures.....	A04
Test equipment and tools.....	A06
Installation position of components.....	A12
Separation of measuring and control unit.....	A15
Diagram of air and fuel lines.....	A17
How to use trouble-shooting chart and trouble-shooting program.....	B01
Trouble-shooting chart.....	B03
Test chart for universal test adapter.....	B04
Trouble-shooting program.....	C17
Index.....	N25

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